the OIL AND GAS JOURNAL

BJ engineering puts power to work for you...

POWAIRMATIC TUBING TONG
...fast, positive make-up and break-out

Here's how you save when BJ engineering puts *power* to work for you! When you use the BJ Powairmatic Tubing Tong you save on crew time . . . you increase safety . . . you get back on production faster!

Speed – the BJ Powairmatic has two power speeds – low gear for breaking out . . . high gear for fast spinning and make-up.

Accurate Make-up – the BJ Torque Indicator – an exclusive feature – provides accurate torque readings which insure uniform make-up of the entire string.

Positive Power – permanently lubricated transmission gears power through chain drive to the rotating gripping mechanism . . . providing positive grip without crimping.

Ease of Operation – automatic alignment and positioning for stabbing and removal...true-balance suspension...ONE-man operation.

Adaptability – interchangeable jaws and bushings handle tubing sizes from 1¼" to 3½" (4" O.D.).

You'll save crew time on the first stand you break out with this fast, powerful BJ tool. See the BJ Representative in your territory – or write today for new bulletin.

Byron Jackson Co.

MEANS ENGINEERED OIL TOOLS

PRICE 50 CENTS

TABLE OF CONTENTS PAGE 65

OCTOBER 18, 1951

Have you talked to your Lane-Wells Man lately about

Engineered PACKER SERVICE

The 8 Points of LANE-WELLS ENGINEERED PACKER SERVICE

1 DO I NEED A PACKER?
Analysis of well conditions often reveals that a packer, though applicable, would be less desirable than some other piece of equipment. Lane-Wells men recommend the tool best suited to your needs.

2 WHAT CAN PACKERS DO FOR ME?
Operators are sometimes surprised to find how wide a variety of oil field operations packers perform. Lane-Wells men can work out with you packer settings for a range of down-the-hole jobs.

3 WHICH PACKER IS RIGHT FOR THIS JOB?
Most operators are aware that different types of packers can be used—but only one is really right for the job. Your Lane-Wells field man can help you select that one right packer.

4 HOW TO SET THIS PACKER?
There are at least 15 different factors which must be taken into account to assure a proper packer setting. Lane-Wells field men lay out packer settings on which you can rely.

5 HOW ABOUT PULLING A PACKER?
Pulling a packer involves as many factors as setting. Your Lane-Wells packer expert plans procedures which pull packers efficiently.

6 HOW TO GET THE MOST FROM A PACKER.
Your Lane-Wells man can review your packer programs, tell you how to evaluate their efficiency, and show you what to expect from a packer.

7 IS THIS PACKER STILL GOOD?
Many used packers have been saved for further service by Lane-Wells field men, who can advise on proper maintenance and on both field and shop repair and reconditioning.

8 IMPROVED EQUIPMENT.
We thought this went without saying, but after the favorable comments on SLYDEZE Slips and the new BOCI packer, we include it to remind you that Point 8 is always present.

Tomorrow's Tools-Today!

If you haven't, he's got some interesting things to tell you. Because now, after a little more than a year since Engineered Packer Service was announced, your Lane-Wells man has a lot of convincing evidence that it pays off for operators who use it. He can recite chapter, book and verse, give you actual case histories, that prove the value of this free service on any packer problems you might have.

ASK YOUR LANE-WELLS MAN!

...by...

LANE WELLS

HOW Du Pont *CAN HELP YOU GAIN* maximum gasoline stability with minimum antioxidant treating costs

TO ASSIST REFINERS in the efficient, economical use of additives, Du Pont maintains five strategically located district laboratories. This picture shows the up-to-date, fully-equipped chemical section of the Houston, Texas, laboratory.

Have you recently evaluated the relative effectiveness of different Du Pont antioxidants in your gasoline stocks? The chances are that it will pay you to do so . . . in terms of both greater stability and lower treating costs.

Changing crude sources, for example, may alter the response of your gasoline to the antioxidant you are now using. To meet such variations, Du Pont makes two different types of antioxidants. No. 5 is an aminophenol, and No. 22 is a phenylenediamine.

To help you select the most efficient antioxidant for your particular stocks, there is a Du Pont District Laboratory conveniently located in your area. A member of the laboratory staff will be glad to go directly to your refinery to take samples.

Our personnel have had many years' experience in antioxidant treating problems. This enables them to quickly select the proper concentration range for investigation, and to determine the most effective method of testing. As a result, their recommendations—based on your own refinery processing operation—can be valuable in meeting stability specifications at minimum cost.

Du Pont Antioxidants are available from warehouses in Houston, Texas; Los Angeles, Calif.; and Carney's Point, N. J.

NOW AVAILABLE AT NEW LOW COST!
The price of all Du Pont Antioxidants has recently been reduced . . . write the nearest Du Pont district office listed below for full details.

DU PONT
REG. U. S. PAT. OFF.

Better Things for Better Living . . . through Chemistry

Petroleum Chemicals

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Petroleum Chemicals Division • Wilmington 98, Delaware

District Offices: New York, N. Y. · Chicago, Ill. · Tulsa, Okla. · Houston, Texas · Los Angeles, Calif.

District Laboratories: Wilmington, Del. · Chicago, Ill. · Tulsa, Okla. · Houston, Texas · El Monte, Calif.

IN CANADA: Canadian Industries Limited—Toronto, Ont.—Montreal, Que.

The Oil and Gas Journal, published Thursdays by The Petroleum Publishing Company. Entered as second-class matter September 1, 1910, at post office at Tulsa, Okla., under act of March 3, 1879. U. S. and foreign rates to the petroleum industry, $3 yearly. Copyright 1951.

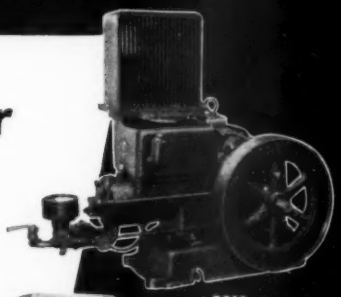
You can Pick the Power to fit the Pump

with the "ZC"

Because the Fairbanks-Morse line of "ZC" Engines is so broad, you can pick the size that will best fit your pumping requirements . . . from 3 to 30 hp.

Fairbanks-Morse "ZC" Engines are high displacement, slow-speed, heavy-duty models . . . the ideal type for oil field pumping service. They are economical to operate and maintain . . . simply designed to eliminate need for complicated parts and delicate adjustments. And, *all* have the famous extra heavy, double flywheels that assure smooth, efficient performance . . . with the drive on either side of the engine.

For all the facts, see your local supply store or write Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago 5, Ill.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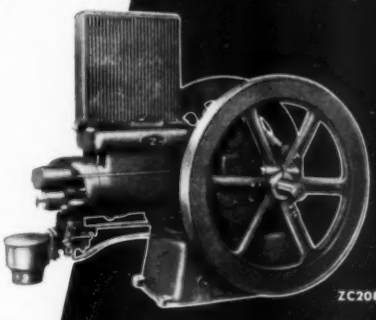
ZC118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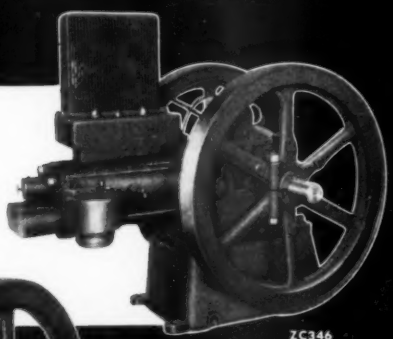
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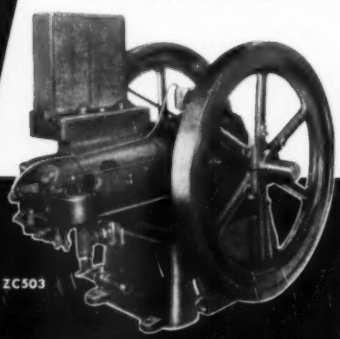
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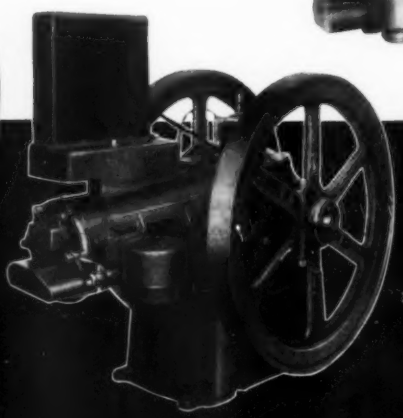
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FAIRBANKS-MORSE,

a name worth remembering

OIL FIELD EQUIPMENT • PUMPS • SCALES • ELECTRIC MOTORS • GENERATORS • LIGHT PLANTS • DIESEL, DUAL FUEL AND GASOLINE ENGINES • MAGNETOS • DIESEL LOCOMOTIVES

For logging

For sand and gravel

For aircraft

For marine

For construction

For stone quarries

For better service and more economy . . . use

MACWHYTE WIRE ROPE

PREformed and Internally Lubricated

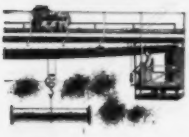
A THOUSAND AND ONE

to order from assures the right rope for your equipment

For elevators

For mining

For drilling



For industrial

There is a Macwhyte Wire Rope that has been specially engineered and job-proved for any particular type of equipment you operate. That's why it pays to specify Macwhyte. Over the years, ropes for all types of equipment in every field have been developed by Macwhyte. Recommendations are promptly available either from Macwhyte distributors or Macwhyte Company, 2916 Fourteenth Avenue, Kenosha, Wisconsin.

Ask for these helpful bulletins:

"Wire Rope—So What?" (No. 5134)—Illustrated exclusive interview with veteran wire rope engineer who talks straight from the shoulder about saving hundreds of wire rope dollars.

"How to Order Wire Rope" (No. 5025)—Tells exactly what to consider. Also includes convenient table of sizes, constructions, strengths and weights of Improved Plow Steel Wire Ropes.

Mill depots: New York • Pittsburgh • Chicago • Minneapolis • Fort Worth • Portland • Seattle • San Francisco • Los Angeles. Distributors throughout U. S. A. and other countries carry stocks.

1010

Something New IN "NATIONAL BLUE"

IDEAL TYPE "E" HOOK BLOCKS

National Supply announces the new line of IDEAL Hook Blocks, for working capacities of 90, 140 and 200 tons, designed to utilize the maximum strength of 1"—1⅛"—1¼" lines respectively with a reasonable factor of safety.

The Type "E" Hook Blocks are a unitized assembly, composed of a traveling block and combination hook and connector. These new blocks effect the maximum saving of vertical derrick space —between block cap and swivel bail.

Operators can use IDEAL Hook Blocks as a hook to support the swivel bail directly, or the drilling string may be supported by the elevator with links connected to the hook line support.

Write for more information, or check at your nearby National Supply Store.

Features of the new Hook Block line include:

- ★ Sheaves mounted independently on tapered roller bearings
- ★ Interchangeable sheave and bearing assemblies
- ★ Each sheave bearing lubricated individually
- ★ All parts locked securely for safety
- ★ Automatic-latching hook tongue cannot open under load

THE NATIONAL SUPPLY COMPANY

General Sales Offices: Toledo, Ohio

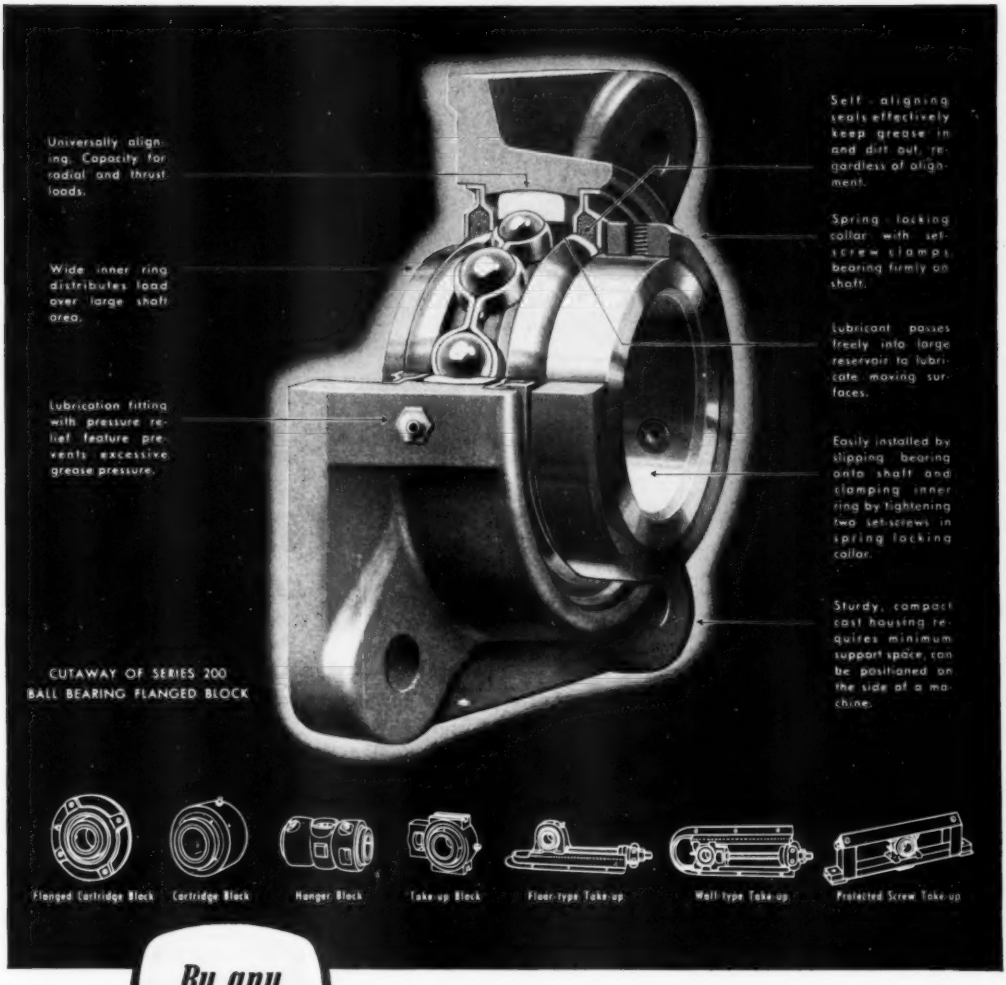
NATIONAL BLUE PRODUCTS

DIVISION OFFICES: CASPER; FORT WORTH; HOUSTON; PITTSBURGH; TULSA; TORRANCE.

CANADA: THE NATIONAL SUPPLY COMPANY, LIMITED, 702 BARRON BUILDING, 610 EIGHTH AVE., WEST, CALGARY, ALBERTA.

EXPORT: NATIONAL SUPPLY EXPORT CORPORATION, 600 FIFTH AVENUE, NEW YORK 20, N.Y., U.S.A.; RIVER PLATE HOUSE, 12 S. PLACE, LONDON E.C. 2

LINK-BELT Ball and Roller Bearings smooth the path of power


Universally aligning. Capacity for radial and thrust loads.
Wide inner ring distributes load over large shaft area.
Lubrication fitting with pressure relief feature prevents excessive grease pressure.
Self-aligning seals effectively keep grease in and dirt out, regardless of alignment.
Spring-locking collar with set-screw clamps bearing firmly on shaft.
Lubricant passes freely into large reservoir to lubricate moving surfaces.
Easily installed by slipping bearing onto shaft and clamping inner ring by tightening two set-screws in spring locking collar.
Sturdy, compact cast housing requires minimum support space, can be positioned on the side of a machine.
CUTAWAY OF SERIES 200 BALL BEARING FLANGED BLOCK
Flanged Cartridge Block
Cartridge Block
Hanger Block
Take-up Block
Floor-type Take-up
Wall-type Take-up
Protected Screw Take-up

By any standard . . .

LINK-BELT builds a bearing block for every purpose

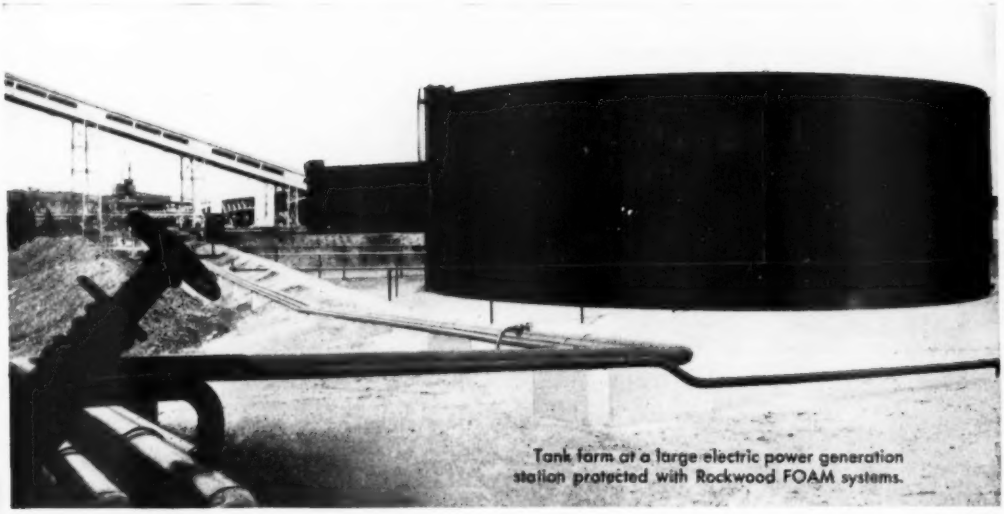
To meet any industrial requirement, Link-Belt builds ball and roller bearings in a complete line of mounting designs. All are made in a wide range of types and sizes . . . all are precision built for top efficiency and dependability. A Link-Belt bearing specialist will show you how the right bearing can be applied to match your exact needs. Or you can get engineering information from Data Book 2550.

LINK-BELT

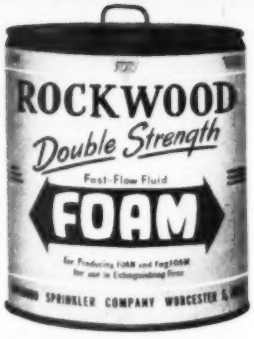
Ball and Roller Bearings

LINK-BELT COMPANY

Indianapolis 6, Dallas 1, Houston 1, Los Angeles 33, Kansas City 8, Mo., New York 7, Toronto 8.
Distributors in all fields. 12.437



Tank farm at a large electric power generation station protected with Rockwood FOAM systems.



better FIRE PROTECTION begins with ROCKWOOD PRODUCTS

You'll be surprised at all the places in your refinery — plant or city where Rockwood fire fighting products can help you *cut fire losses.*

Year after year Rockwood engineers stride ahead giving fire fighters spectacular new developments to combat serious fires in highly volatile flammable liquids and materials. One of the most recent developments has been the new Rockwood *Double strength* FOAM liquid. This new type extinguishing agent is a *fast-flowing* FOAM that covers burning surfaces faster — completely seals off combustible vapors — flows freely at sub-zero temperatures (-15°F) and is easier for firemen to handle. It will cling to smooth, vertical or curved surfaces and has many advantages over ordinary FOAM liquids or powder foams.

New Rockwood proportioning equipment, FOAM and Fog-FOAM Nozzles enables fire fighters to apply Rockwood FOAM Liquid and wetting agent more efficiently to most fires.

Ask your fire equipment distributor, today for complete data and prices on Rockwood's growing family of modern fire fighting products.

New Lightweight type FFF Rockwood FogFOAM Nozzle. Discharges FogFOAM — solid FOAM stream or High Velocity WaterFOG. →

Rockwood FOAM Eductor can be attached between discharge of fire truck and hose line or between hydrant and hose line or between two lengths of hose.

Rockwood Lightweight "FF" Extension unit with SG-60 WaterFOG Nozzle attached. Discharges FogFOAM, solid FOAM stream, high velocity WaterFOG, solid stream or low velocity WaterFOG.

ROCKWOOD SPRINKLER CO.
104 HARLOW STREET, WORCESTER 5, MASS.
PORTABLE FIRE PROTECTION DIV.

ROCKWOOD

It's new... so it's MARLEY!

TWINFLEX

cooling tower drive shaft and flexible coupling

Angular deflection and load fluctuation no longer constitute service problems in cooling tower operation. By applying power through pre-loaded, bonded-to-metal inserts of pressure moulded neoprene, TWINFLEX drives fully compensate for starting loads and misalignment. This means protection to costly bearings and gears, and eliminates maintenance. These couplings require no lubrication . . . in fact are impervious to oil as well as water. TWINFLEX dynamically balanced drive shafts are of electro-galvanized tubular steel and are sealed against internal corrosion. The TWINFLEX drive shaft and flexible coupling are the first application of this most modern design power transmission to cooling towers . . . another in the long line of exclusive engineering advancements that makes Marley the world's largest producer of water cooling towers.

producers of
- DOUBLE FLOW TOWERS
- DRICOOLERS
- AQUATOWERS
- NATURAL DRAFT TOWERS
- CONVENTIONAL TOWERS
- SPRAY NOZZLES
- VAIRFLO TOWERS

MARLEY

The Marley Company, Inc.

KANSAS CITY 5, MISSOURI

TWINFLEX is a trademark of the Marley Company, Inc.

IN *Good* STANDING

WITH THE *OIL* FRATERNITY

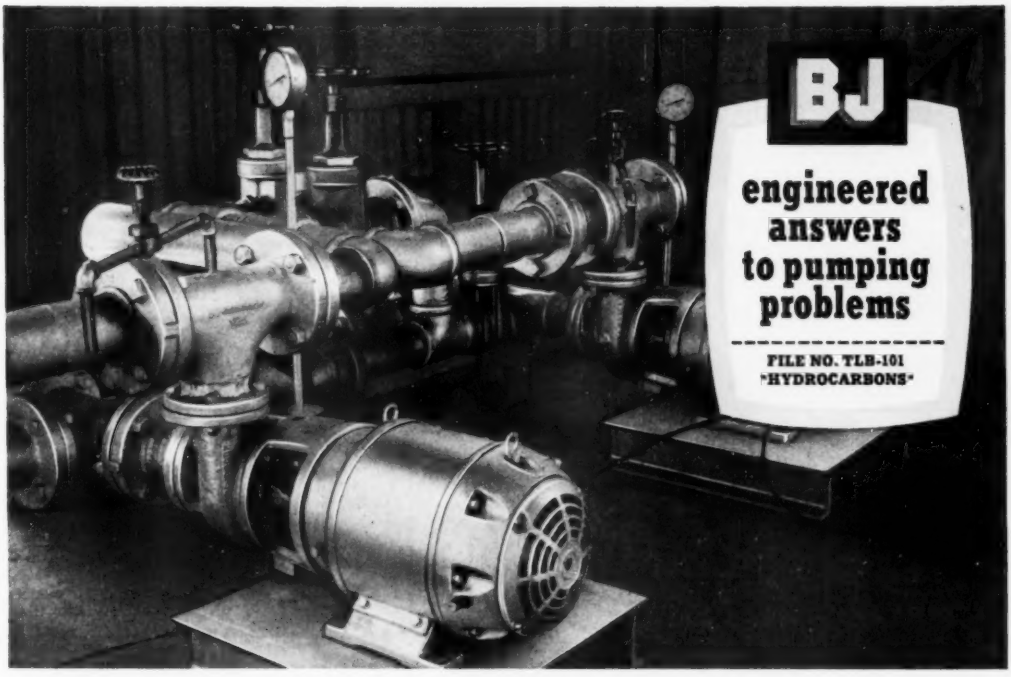
For many years, oil operators, contractors and suppliers have counted on NBT for experienced, prompt and confidential help concerning their financial requirements. NBT's oil bankers know and talk oil. NBT has the resources and facilities available to finance large or small operations. As your plans are completed, bring them to NBT — the bank in good standing with the great oil fraternity.

The Oil Bank of America

NATIONAL BANK OF TULSA

OFFERING COMPLETE BANKING AND TRUST SERVICES

Member Federal Deposit Insurance Corporation



General Petroleum reports:

Mechanically-sealed BJ Type TLB Pumps handle hydrocarbons without leakage, fire hazard, repacking problems or special operating attention

Byron Jackson engineers developed the TLB pump to solve the leakage, fire hazard and repacking problems faced in the handling of hydrocarbons. Formerly, the only pumps which met these requirements represented a considerable investment in cost and installation. Now, the BJ Type TLB offers a sensibly-priced unit, easily installed and operated with a minimum of attention. It features a simple, efficient BJ Mechanical Seal which replaces the packing in the stuffingbox and provides a reliable safeguard against leakage.

The installation shown above is at General Petroleum's Bakersfield Bulk Plant. Two BJ Type TLB Pumps are used here for loading gasoline and diesel fuels, pumping 160 gpm against 62 ft. total head. Explosion-proof 3 hp, 3-phase, 60 cycle, 220/440 v motors operate at 3550 rpm.

For the engineered answer to *your* standard or special pumping needs contact your local BJ sales office or write direct. For more information on these TLB Pumps—including pump selection table and friction compensation charts—send the coupon below.

FILE FACTS:

- Unitized design simplifies installation—needs no base plate—saves space—mounts at any angle.
- No packing to maintain.
- BJ Mechanical Seal cooled by pumped liquid.
- Single-stage, single-suction pump sizes from 1¼" to 4".
- Close-coupled construction allows more efficient application of power to pump.
- Capacities to 1000 gpm. Heads to 200 ft.
- Discharge pressure: 75 psi.
- Max. working temperatures: 150°F.
- Explosion-proof motors.

Byron Jackson Co.
Since 1872
P.O. Box 2017, Terminal Annex, Los Angeles 54, Calif.
Offices in principal cities

PUMP DIVISION, Dept. 28
Please send me your TLB Bulletin No. 50-9200

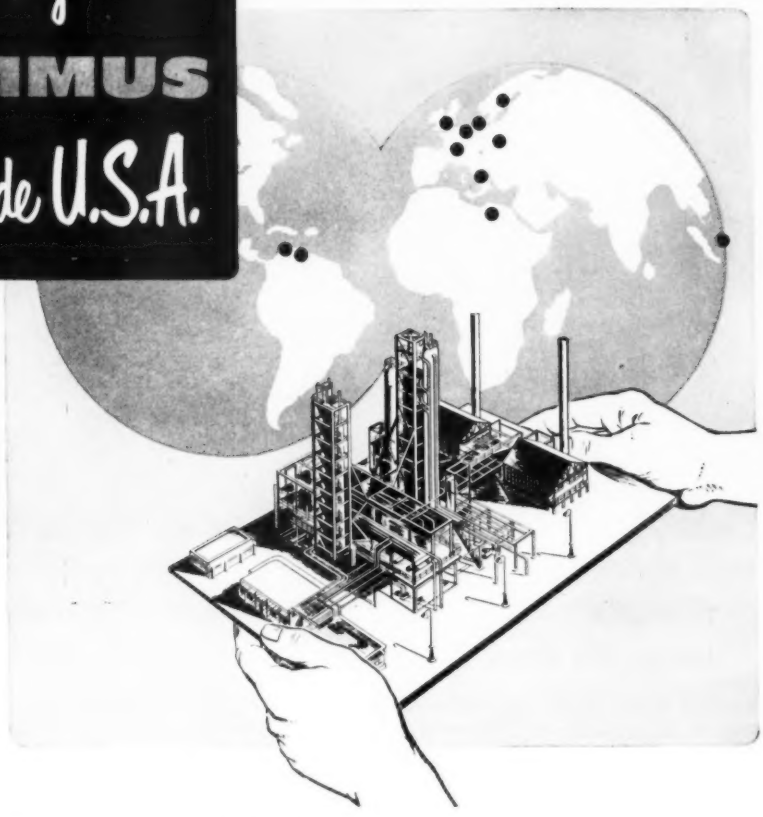
Nam._____

Company_____

Address_____

City_____ Zone____ Street_____

...by LUMMUS ...outside U.S.A.



Dots on the globe indicate countries where scores of post-war refinery and chemical projects carry the seal "... by Lummus".

All classes of Lummus service—process design, engineering, construction—are represented in these overseas projects. In a number of cases, combined projects constitute complete oil refineries.

Processes employed include distillation; propane deasphalting; catalytic and thermal cracking; reforming; Polyforming; coking; lube oil manufacture by solvent refining, solvent dewaxing and clay treating; and petroleum chemicals production.

Each job—whether just starting, partially completed, or on stream—bears the Lummus stamp of over-all competence and international experience.

We invite you to consult Lummus on *your* next project.

THE LUMMUS COMPANY

385 MADISON AVENUE, NEW YORK 17, N. Y.

CHICAGO • HOUSTON • LONDON • CARACAS • PARIS

DESIGNING ENGINEERS AND CONSTRUCTORS FOR THE PETROLEUM AND CHEMICAL INDUSTRIES

DOWN-TO-EARTH *experience..*

SINCE 1932 Independent has had from two to eighteen crews in the field at all times . . . operating from the swamps of Louisiana to the Rocky Mountains, in coastal tidewaters, tropical jungles, and on desert sands.

The down-to-earth experience gained through successfully overcoming special problems and adverse conditions provides the "know how" that gets every job done efficiently and makes Independent's service profitable to our clients. You are invited to consult with us about your exploration program.

D. D. Doty has been working up through the Independent organization for 18 years. Now a senior party chief, his service is typical of the extensive geophysical experience of all key personnel at Independent Exploration Co.

POINTING THE WAY IXC FOR THE DRILL

Independent *Geophysical Surveys*

EXPLORATION COMPANY

1973 WEST GRAY ★ HOUSTON, TEXAS

ESTABLISHED 1932

NOW... new heights in

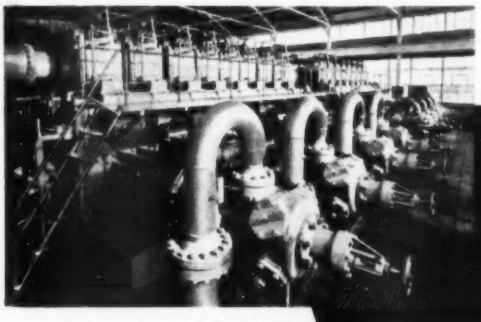
COMPRESSOR CYLINDER EFFICIENCY

It's Clark! First again! First with the Air Cooled Compressor Cylinder . . . the most efficient compressor cylinder ever designed and produced for gas transmission pipelines and other low ratio services.

And it's natural that this major development originates with the only specialist in the heavy duty compressor field. For Clark, in designing thousands upon thousands of compressor cylinders for every type of service, has accumulated experience unmatched in the industry.

But, the Clark Air Cooled Compressor Cylinder is no longer just a *design first*. It's now a *proved-performance first!* Service records established on a number of the nation's pipelines — Tennessee Gas Transmission Corp. and Michigan Wisconsin Pipe Line Co., among them — are the basis of Clark's claims for peak efficiency. And many additional units now on order are further evidence of rapid acceptance.

NEW LITERATURE: Write for bulletin containing design data, and see your nearest Clark representative for full details.



Clark air cooled cylinders installed on a Clark 2000 bhp HLA compressor operated by a large natural gas transmission pipeline company.

SEE the difference in

CLARK COMPRESSORS

with new Clark AIR COOLED DESIGN

PEAK EFFICIENCY

Unusually low valve velocities — Handles maximum amount of gas with minimum power.

Negligible pressure drop — large, smooth gas passages.

Non-restrictive connections — large suction and discharge nozzles.

Single or double deck valves, as required for optimum valve performance.

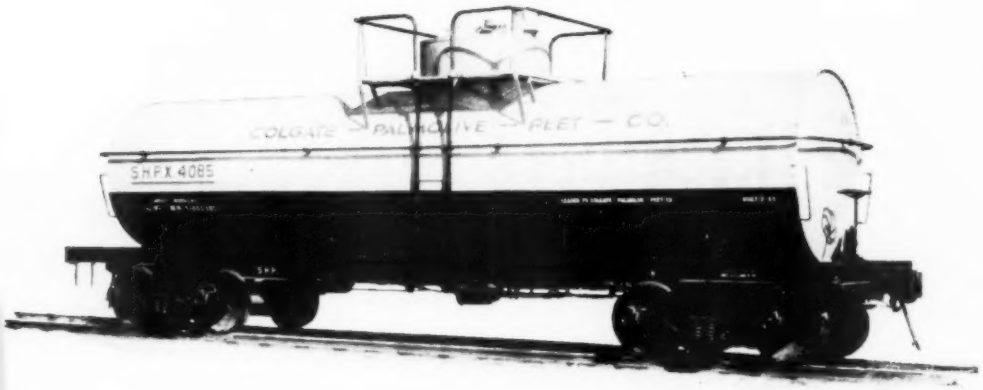
Equal volumetric efficiency via head and crank end clearance pockets.

Built-in Clearance — permits operation over a wide range of conditions.

CLARK BROS. CO., INC. ***One of the Dresser Industries*** **OLEAN, N. Y.**

New York • Tulsa • Houston • Chicago • Boston • Washington • Los Angeles • Birmingham • Detroit • Salt Lake City
San Francisco • Buffalo • London • Paris • Varese, Italy • Ankara, Turkey • Buenos Aires • Caracas, Venezuela • Lima, Peru • Bogota, Colombia • New Delhi, India

It's Kid Glove Handling for HALO Shampoo...



in this contamination-proof tank car... built by a.c.f. for Shippers Car Line and leased by them to Colgate-Palmolive-Peet

When the product you move today is destined to glorify a million heads of hair tomorrow... you need extra-special care—and an extra-special car.

Here's how Shippers Car Line and a.c.f. did it. The tank car you see above has a stainless steel tank, polished to a mirror-like finish inside. Between every shipment, two built-in spray heads rinse the tank clean-as-new. The shampoo that comes out is just as pure as the shampoo that goes in.

Shippers Car Line, operator of thousands of tank cars throughout the country, finds these a.c.f. Cars are economical to maintain... safer to run. Whether you're in the market for one special car or a thousand standard ones, you will be interested in the a.c.f. construction techniques that make such long-range savings possible. Write for information: American Car and Foundry Company, 30 Church Street, New York, N. Y. Other Sales Offices: Chicago • St. Louis • Cleveland Washington • Philadelphia • San Francisco.

a.c.f. **ALL-WELDED TANK CARS** *for Safe Delivery—*

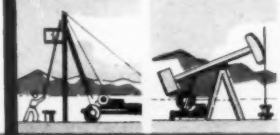
CONSERVE STEEL, AVOID LOST PRODUCTION,

with

KONTOL
conserves steel

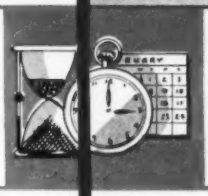
Kontol Corrosion Preventive mixes with the well fluids and adsorbs on the metal surfaces of production equipment as a tough film. This Kontol film prevents attack by corrosive elements, prolonging the useful life of production equipment.

KONTOL ***prevents production stoppages***



By preventing corrosion damage, Kontol helps to keep wells on production. Some wells now treated with Kontol stay on the pump for six months without a shutdown—they formerly were down once a month or oftener.

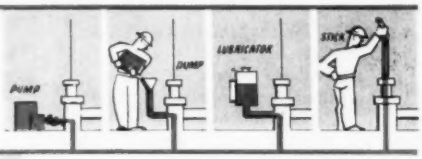
KONTOL
saves time



Saving of lease time is the result of the many advantages of Kontol. Of course, keeping the well on production is the most outstanding, but there are many others. Kontol is easy to use, this fact alone is a time-saver. The use of Kontol does not complicate demulsification procedures. Kontol does not deposit precipitates which may plug producing or water disposal formations.

KONTOL
is easy to use

Kontol is simple to use. It can be pumped, dumped, lubricated or dropped down the well in solid stick form.



KONTOL
is safe to use

Kontol is non-poisonous, it does not give off offensive or dangerous fumes. No bulky protective equipment such as aprons, gloves, goggles or masks are required in its handling.

KONTOL
does not complicate production routine

Kontol does not cause emulsion difficulties. Emulsified crudes from Kontol-protected wells respond to the usual demulsification procedures. Kontol does not deposit precipitates which may plug producing or water-disposal wells.

KONTOL

a product of the **TRETOLITE COMPANY**

ST. LOUIS 19, MISSOURI • LOS ANGELES 22, CALIF.

Chemicals for the Petroleum Industry

CORROSION INHIBITION • DEHYDRATING • DESALTING

SCALE PREVENTION • WATER DE-OILING • PARAFFIN REMOVAL

K51-2

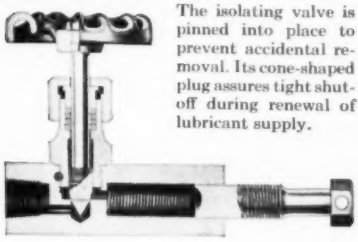
COMPARE

THIS FEATURE

OF THE HONEYWELL SERIES "700" VALVE

SAFETY STEM LUBRICATOR

The Stem Lubricator of stainless steel bar stock has an isolating valve for maintaining safe conditions *at all times.*



The isolating valve is pinned into place to prevent accidental removal. Its cone-shaped plug assures tight shut-off during renewal of lubricant supply.

Specially Designed Neoprene Diaphragm

Duplex Upper Stem Guide

One-Piece Bonnet

Packless Bellows Seal

Wide Variety of Discs

Reversibility in the Field

* Compare the Safety Stem Lubricator of this valve with that of any other wide band proportional type. Look at it closely . . . study it feature by feature.

Then check the other features of the valve . . . the Specially Designed Diaphragm, the Duplex Stem Guide, the One-Piece Bonnet, the Packless Bellows Seal, the wide variety of discs, the easy reversibility in the field.

Your comparison will prove that the Honeywell Series 700 has *all* of the features you look for in a fine valve.

It's available in a wide range of styles and sizes. For detailed information, write for a copy of Bulletin 700-2, or call in your local Honeywell engineer . . . he is as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division,* 1906 Windrim Ave., Philadelphia 44, Pa. Offices in more than 80 principal cities of the United States, Canada and throughout the world.

MINNEAPOLIS **Honeywell**

Valve Products

SERVICE LEDGER
1901-1951

ANGLO-IRANIAN OIL CO. LTD.
ARGENTINE GOVERNMENT OIL FIELDS
ARGENTINE MINISTRY OF WAR
ATLANTIC REFINING CO.
ATOMIC ENERGY COMMISSION
BRITISH AMERICAN OIL CO. LTD.
CANADIAN OIL REFINERIES, LTD
CALIFORNIA REFINING CO.
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CITIES SERVICE OIL CO.
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IMPERIAL CHEMICAL INDUSTRIES
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SINCLAIR REFINING CO.
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SOCIETE DES RAFFINERIES DE PETROLE DE LA GIRONDE
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SOCONY-VACUUM FRANCAISE
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SWIFT AND CO.
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UNION OIL CO. OF CALIFORNIA
UTAH OIL REFINING CO.
WASATCH OIL CO.
WOOD RIVER OIL & REFINING CO.

D-X

Building for product improvement ...with Mid-Continent!

First order from the Mid-Continent Petroleum Corporation, in 1939, was for lube improvement units... deasphalting and acid treating. The following year we were busy again, this time in the gasoline end of the operation, engineering and constructing Mid-Continent's first catalytic polymerization unit.

As part of its immediate post war operations, Mid-Continent ordered a Kellogg Fluid catalytic cracker to lift the overall refinery octane level... and this unit went on stream in 1949. Then just last year Kellogg engineered an alkylation unit for this refiner... a unique one inasmuch as it was designed to run in process series with Mid-Continent's modernized cat poly unit. This operating technique squeezes the maximum volume of high octane fuels from the gaseous by-products of other refinery processes.

THE M. W. KELLOGG COMPANY

A SUBSIDIARY OF PULLMAN INCORPORATED

for fifty years an integral part of processing history

NEW YORK JERSEY CITY LOS ANGELES TULSA HOUSTON TORONTO LONDON PARIS

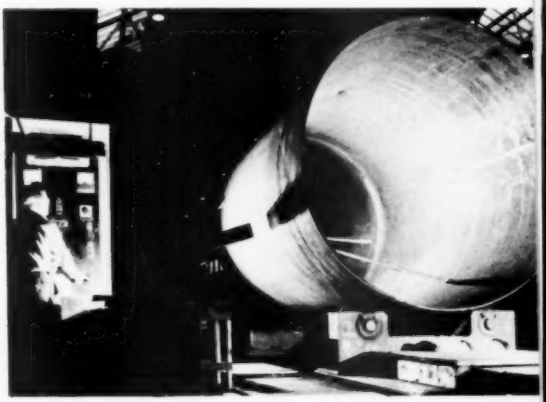
Portrait at

This year is Kellogg's fiftieth of service to industry. At this time naturally, as a group of men—known collectively to the modern business world as The M. W. Kellogg Company—we can think back nostalgically. We can remember the chimney stacks

"Unusual Techniques Set High Quality Level..."

In previous issues of this magazine, "camera portraits" of M. W. Kellogg today have highlighted major aspects of Kellogg's broad research, development, engineering and procurement activities . . . and introduced readers to the company's fabrication facilities.

This month, the camera continues its tour of Kellogg's Jersey City Shops, focusing particularly on some unusual techniques employed by Kellogg to maintain the highest quality in fabricated process piping and equipment.



1. *OUR COMPANY WAS ONE OF THE FIRST* fabricators to adopt radiography in its Shops as a quality check . . . and early developed one of the most extensive radiographic operations in the industry. Beyond utilizing this method as a positive check on specific jobs, Kellogg employs it to evaluate new welders and also to maintain daily welding operations at a high quality level.

4. *A RECENT INNOVATION* in shop procedure for the fabrication of critical power station piping is the ultra sonic testing of "raw" pipe. Developed in conjunction with a leading turbine manufacturer, this application of a modern testing technique should prevent the costly failures that have occasionally occurred because of internal flaws that cannot be discovered by any other practical method.

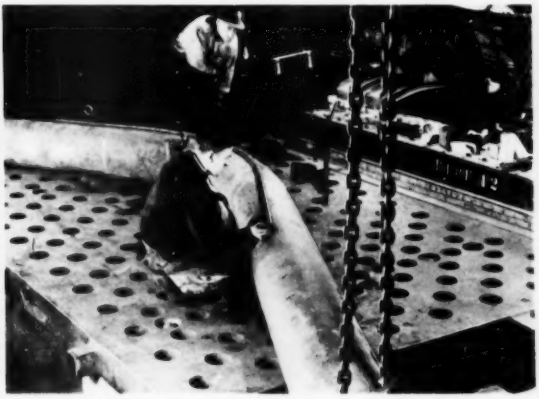
5. *AS FAR AS SIZE IS CONCERNED*, the Shop's facilities for making process piping are virtually unlimited. Pictured is one of industry's first machines for continuous longitudinal welding of the interior of pipe. The use of advanced equipment is typical of Kellogg shops . . . in fact, almost every step in fabrication is accompanied by either exclusive techniques or exclusive equipment.

Fifty... no 9

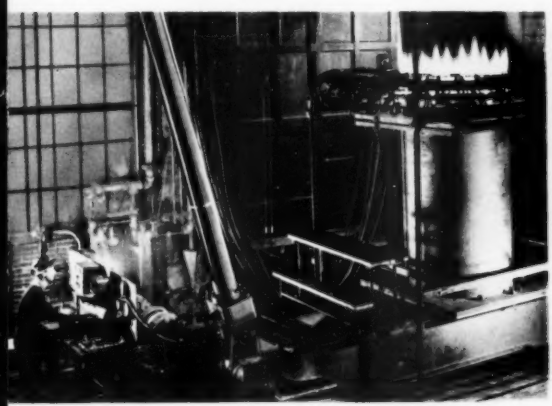
KELLOGG
1901-1951
50th Anniversary

we built in 1901 . . . the first crude vessels for oil refiners in the 'teens . . . our first combination unit . . . the forty-odd Fluid cat crackers built in these years. But, after all, The M. W. Kellogg Company is only a factor as it is able to serve industry today. For that reason, we are presenting this series of monthly camera studies which document our belief that a truly integrated organization can better serve industry to achieve greater earning power. This is No. 9 in the series.

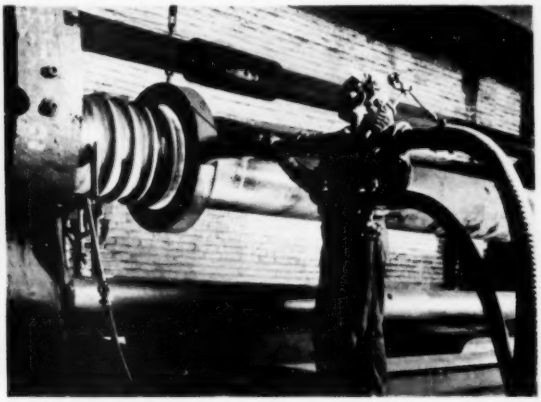
2. *STRESS RELIEVING FURNACES* are a basic element of the Shops' facilities. However, from this more-or-less routine shop operation, Kellogg metallurgical groups have evolved special stress relieving "specs" and techniques that have proved invaluable in the field—both in fabrication of vessels and in the installation of piping systems for power and process applications.



3. *PROCESS PIPING OF ALL TYPES* represents a major part of the Shops' volume—with high-temperature, high-pressure piping systems for utility power stations also being an important phase of Contract Engineering volume. Some recent Kellogg firsts in this latter highly specialized field are the first installation to operate at 1050°F and 1730 p.s.i.g. and the first stainless steel alloy installation.



6. *THIS KELLOGG INVENTION* can bend process pipe up to 96 inches in diameter . . . with continuous, even contour. Operated through electrical controls, the machine produces giant pipe bends that have promoted processing efficiency by minimizing erosion and stress corrosion and markedly reducing turbulence.



7. *ON THIS MACHINE, KELLOGG* fabricated the first 30 inch O.D. diameter alloy corrugated piping through use of much the same technique as employed on the Giant Bender: controlled incremental heating and subsequent controlled application of pressure.

NEXT MONTH

. . . in the tenth of this series of camera studies of M. W. Kellogg today . . . the camera completes the Shop story and moves out on the construction lot to review some of the methods Kellogg employs to win "construction's battle with time."

Low maintenance...welded in!

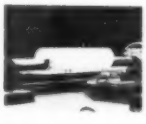
Such details as the positioning of this simple weld on an exchanger baffle plate can radically vary maintenance costs of an operating exchanger. Low maintenance costs have been a design fetish of Kellogg engineers for many years. They design with low maintenance as a principal "spec"...then see that the "spec" is reproduced in every piece of Kellogg-fabricated equipment.

Pressure Vessels
Vacuum Vessels
Fractionating Columns
Drums and Shells
Heat Exchangers
Process Piping
Hi-pressure - Hi-temp Power Piping
Bends and Headers
Giant One-Piece Bends
Forged and Welded Fittings
Radial Brick Chimneys

Continuing Basic Study of heat exchanger fly Kellogg development groups over 20 years has produced unduplicated design data.

Shop Layout Craftsmen have had experience on all types of heat exchangers, from marine condensers to jet engine combustion chambers.

Rigid Quality Control is maintained by inspectors reporting directly to Shop Management rather than to Production executives.



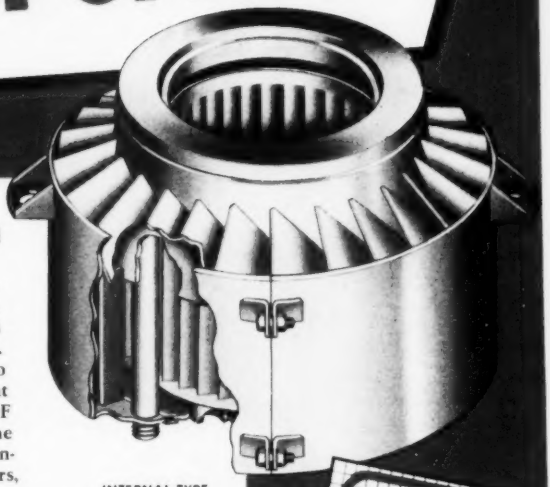
Extensive Shop Facilities from plate forming to stud threading, permit complete fabrication of any type heat exchanger.

Special Shop Techniques—the component parts of each exchanger are fabricated as a production unit, building in the advantages of tailor-made fit.

NEWS FOR OPERATORS IN WESTERN CANADA:
The Canadian Kellogg Company Ltd. has established complete shop facilities for the fabrication of all types of piping at **EDMONTON, Alberta**. Inquire directly or through any Kellogg or Canadian Kellogg office.

The M. W. Kellogg Company (A Subsidiary of Pullman Incorporated) **New York, Jersey City, Los Angeles, Tulsa, Houston, Toronto, London, Paris**

ANNOUNCING the NEW Anderson Hi-eF Purifiers



INTERNAL TYPE PURIFIER
Bulletin #100

DELIVERS VIRTUALLY 100% QUALITY VAPOR!

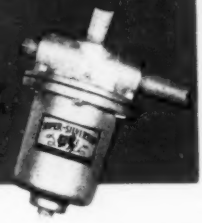
Now, the V. D. Anderson Company, makers of Super-Silvertop Steam Traps, offers you a complete line of new Anderson Hi-eF Purifiers —the finest separating devices ever developed. These high efficiency units are guaranteed to remove virtually 100% of the entrainment from vapors—*even at extreme velocities!* Hi-eF Purifiers quickly amortize themselves. The internal-type Purifier illustrated here, for instance, produces clean steam from boilers, thereby increasing the life span of reciprocating engines, turbines, and super heater tubes. In evaporator operation, they boost production and in food and petroleum processing, assure a better, purer product.

Install Anderson Hi-eF Purifiers and forget them . . . they are self cleaning . . . without baffles or any moving parts. Good fluid dynamic design permits extremely low pressure drop.

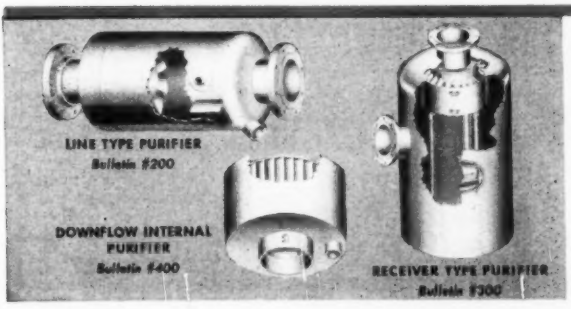
Anderson Hi-eF Purifiers give you purifier efficiency at the price of an ordinary separator! Save by investigating these new, money saving units today. Anderson makes complete range of types in all sizes to any specifications.

Mail coupon for further information today.

ANDERSON Hi-eF PURIFIERS



MADE BY THE MAKERS OF SUPER-SILVERTOP STEAM TRAPS AND STRAINERS



PURIFIER DIVISION,
THE V. D. ANDERSON COMPANY
1981 West 96th Street • Cleveland 2, Ohio

Gentlemen: Please send additional information on Anderson Hi-eF Purifiers described in:

☐ Bulletin #100 ☐ Bulletin #300
☐ Bulletin #200 ☐ Bulletin #400

Name .....
Company .....
Address .....
City ..... Zone .... State .....

more dirt moved day after day....

Bucyrus-Erie Bulldozers do the job faster....

Fill in used pits on your lease in double time with fast Bucyrus-Erie Bullgraders and 'dozers — and use these speedy dirt-movers for dozens of other jobs, too — digging new pits, clearing drilling locations, building access roads, and many more.

Speed is identified with Bucyrus-Erie Bulldozers and Bullgraders because the *balanced design* of the blade equipment permits full use of tractor power. The tractor's balance point is practically unchanged after addition of the blade attachment, thus maintaining full tractive effort, true maneuverability, real fuel economy, and concentrating maximum pushing force where it's needed most — at the blade.

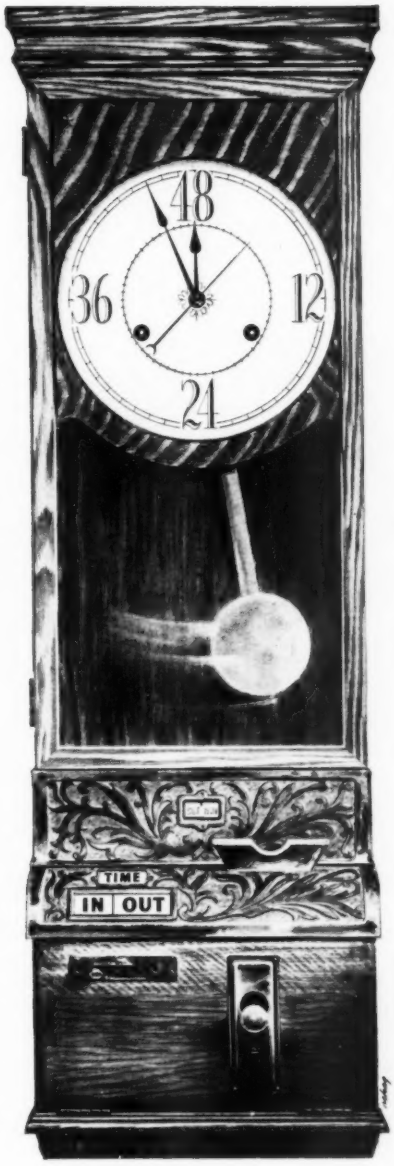
Your International Industrial Tractor Distributor can prove to you that this perfectly matched earth-moving team will handle your chores in record time — see him *now* for the whole story!

295T51

BUCYRUS ERIE

SEE YOUR INTERNATIONAL INDUSTRIAL TRACTOR DISTRIBUTOR

SOUTH MILWAUKEE, WISCONSIN



Too bad it can't be invented!

If someone could invent a day 48 hours long, you can be sure Kaiser Steel would be among the first to adopt it.

But Kaiser Steel is working around the 24-hour clock to produce more steel in order to meet pressing demands for many products—including Kaiser Steel line pipe.

Backing up this work schedule, Kaiser Steel is constantly expanding plant facilities to bring still more steel to the West.

Kaiser Steel line pipe to conform to latest API specifications is produced in diameters from ½ inch to 30 inches, and in lengths up to 55 feet. Shipping points are Fontana and Napa, California.

It's good business to do business with

Kaiser Steel

KAISER STEEL PIPE SPECIFICATIONS • All pipe manufactured to latest A.S.T.M. and A.P.I. specifications

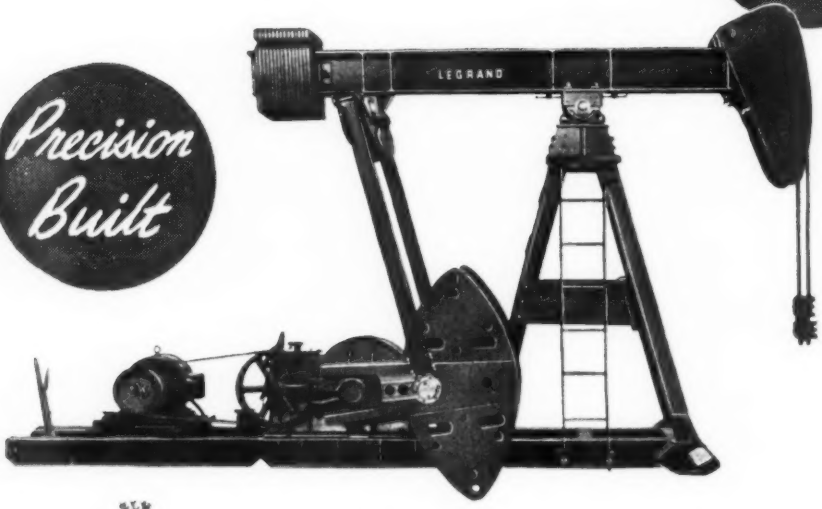
Type	Diameter	Length	Wall Thickness	Shipping Point
Continuous Weld—Threaded and Coupled	½" to 4" nominal I.D.	Uniform 21'	Standard	Fontana, Calif.
Continuous Weld—Plain End	2⅜" to 4½" O.D.	Up to 40'	Standard	Fontana, Calif.
Electric Resistance and Fusion Weld—Plain End	8⅝" to 20" O.D.	Up to 40'	.188" to .500"	Napa, Calif.—Basalt-Kaiser
Electric Resistance Weld—Plain End	5⅝" to 12¾" O.D.	Up to 55'	.188" to .400"	Fontana, Calif.
Electric Fusion Weld—Expanded—Plain End	22" to 30" O.D.	Up to 40'	.188" to .500"	Napa, Calif.—Basalt-Kaiser

Prompt, dependable delivery at competitive prices • **KAISER STEEL CORPORATION** Los Angeles, Oakland, Seattle, Portland, Houston, Tulsa, New York

LE GRAND

Best in the Field

Precision Built



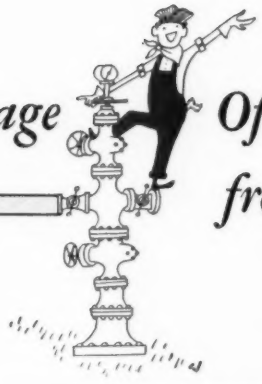
THE smooth, rugged power of LE GRAND precision built pumping units gives a field efficiency that ensures constant production with low maintenance costs.

Le Grand units, robust in construction, embody features consistent with sound design, reliable service, and the exacting requirements of the variable conditions found in the World's oilfields. Le Grand are also manufacturers, under license, of the well head and ancillary equipment of the Oil Center Tool Company, Houston, Texas.

OILFIELD EQUIPMENT

LE GRAND SUTCLIFF & GELL LTD

HORSTED AIRPORT · ROCHESTER · KENT · ENGLAND



A Message Of Thanks from The Columbia Gas System *to* All Its Suppliers

We, of the Columbia Gas System, are sincerely grateful to our suppliers for all their efforts in our behalf during the past difficult year.

The unavoidable steel shortages created by our country's re-armament policy . . . the unpredictable and often disastrous vagaries of weather . . . have made for an extra and heavy burden on all.

Our mutual task remains . . . to bring the benefits of Natural Gas to more people and to more industries.

Thanks for your help.

Stuart M. Crocker

STUART M. CROCKER
Chairman

George S. Young

GEORGE S. YOUNG
President

COLUMBIA GAS SYSTEM

GLOBE

Complete Process Control . . . from billet – to tube – to fitting

assures you the finest in WELDING FITTINGS

Only Globe's precision process of manufacturing seamless welding fittings *begins with the billet*! For Globe alone among welding fitting manufacturers produces seamless tubing . . . and Globe alone has the facilities to provide exact technical control at every stage of manufacture — from billet — to tube — to fitting — *in its own plant*. That's one reason why users who want dependable fittings specify Globe!

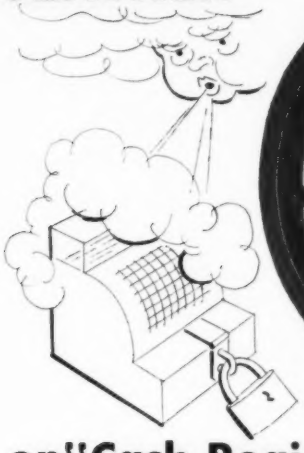
GLOBE STEEL TUBES CO.
MILWAUKEE 46, WISCONSIN

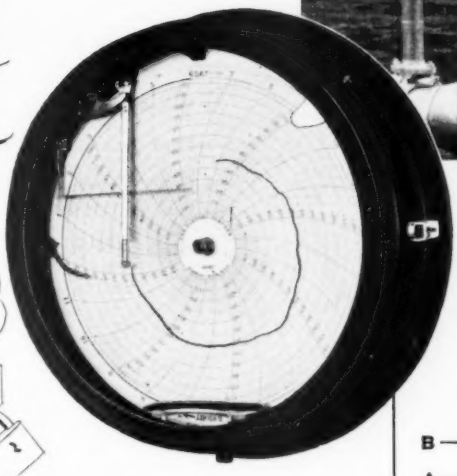
Chicago • Cleveland • Detroit • New York • Philadelphia • St. Louis • Denver • San Francisco • Glendale, Cal.

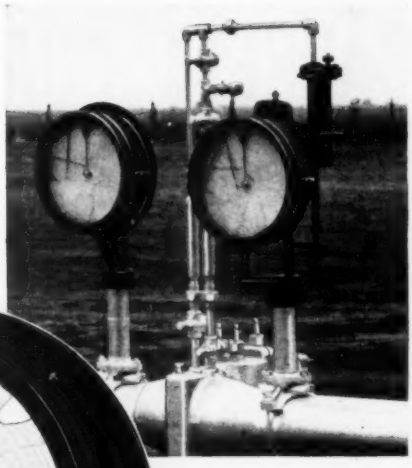
Producers of Globe seamless stainless steel tubes — Gloweld welded stainless steel tubes — alloy — carbon — seamless steel tubes — Globeiron (high-purity ingot iron) seamless tubes — Globe Welding Fittings.

For complete information on the finest welding fittings available anywhere, send for the Globe Welding Fittings Catalog.

GUARD YOUR TILL FROM OLD MAN WEATHER







Above — *Foxboro Anti-Ambi Recorder and Foxboro Flow Meter.*

***Left**—The Anti-Ambi Recorder*

on "Cash Register" metering

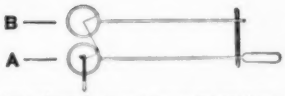
You can be sure you're ringing up your full money's worth of *actual* gas volume — regardless of weather ups and downs — when you have the protection offered by Foxboro Anti-Ambi Temperature Recorders.

In orifice-type metering, a variation of only 10 F. in gas temperature will cause an error of 1% in metered volume, unless corrected. And that means substantial losses over a prolonged period. With Foxboro Anti-Ambi Temperature Recorders you get continuous, accurate records, permitting full correction for temperature variations and precise computation of gas delivery in standard volume units.

The Anti-Ambi Recorder has the ruggedness and accuracy typical of Foxboro Instruments. Weather-tight case permits installation out-of-doors. Fully compensated for ambient temperature changes. These are some of the reasons why the gas industry uses more Foxboro Anti-Ambi Temperature Recorders than all others combined.

Write for complete information. **The Foxboro Company, 605 Neponset Ave., Foxboro, Mass., U.S.A.**

TYPICAL FOXBORO REFINEMENTS



The diagram above shows the Foxboro automatic compensation for ambient temperatures. Measuring and compensating elements are located in the same case, and capillaries for both systems are in the same protective tubing. The compensating system automatically resets the primary measuring system to correct for ambient temperature changes. Instrument and compensation are calibrated at same time.

Here's the small-diameter, quick-response bulb used with the Foxboro Anti-Ambi Thermometer. Bulb is made with a stainless steel neck to reduce conduction effects.

The bulb is generally protected by the special socket shown above. It has aluminum fins for rapid heat transfer, and a stainless steel extension to minimize heat conduction to the socket head.

FOXBORO REG. U. S. PAT. OFF. **Anti-Ambi THERMOMETERS**

FACTORIES IN THE UNITED STATES, CANADA AND ENGLAND

BARRETT* COAL-TAR ENAMELS

PROTECT

AMERICA'S GREATEST PIPELINES

HERE ARE* 10 REASONS *WHY...

1 Products and procedures available for every oil and gas pipeline requirement.

2 Withstand extremely high and low temperatures.

3 High ductility and flexibility.

4 Coatings not damaged by "breathing," nor by back-fill stresses.

5 High dielectric properties.

6 Impermeable to moisture.

7 Resistant to attack by gas and petroleum products.

8 Used by thousands of engineers and contractors.

9 Universally available and easy to apply—applicators all over the country.

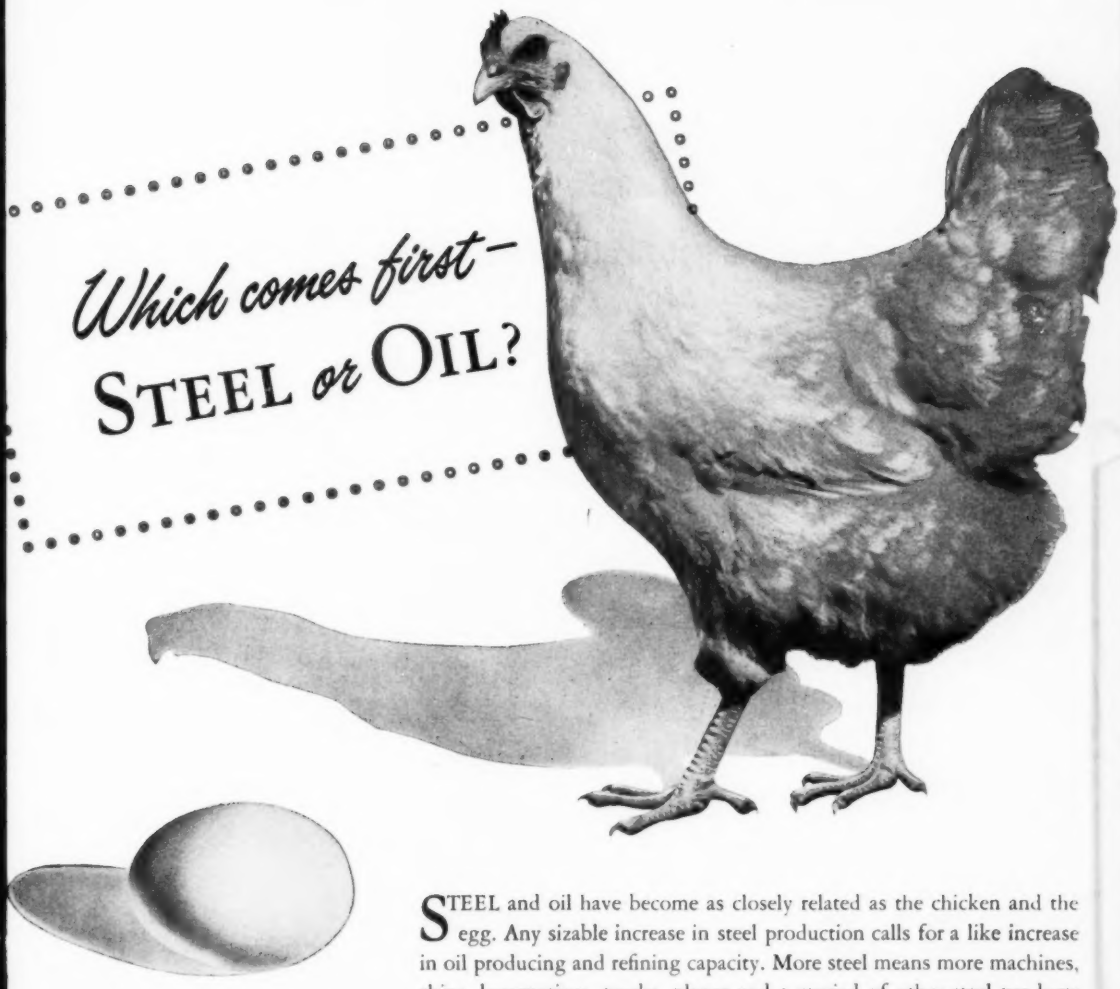
10 Barrett engineering service always available.

Barrett*

THE BARRETT DIVISION
ALLIED CHEMICAL & DYE CORPORATION
40 Rector Street, New York 6, N. Y.

*Reg. U. S. Pat. Off.

Barrett* Coal-Tar Enamels protect The El Paso Natural Gas Lines



Which comes first— STEEL *or* OIL?

STEEL and oil have become as closely related as the chicken and the egg. Any sizable increase in steel production calls for a like increase in oil producing and refining capacity. More steel means more machines, ships, locomotives, trucks, planes and a myriad of other steel products that need fuels and lubricants. And that will take more steel to drill wells and to build pipe lines and refineries.

New steel plants and refineries are both "first" at McKee—and both in a hurry. McKee maintains separate divisions for iron and steel plant and petroleum refinery design, engineering and construction. The combined technical knowledge and experience of these two divisions are particularly advantageous to McKee clients in the present expansion program.

DESIGN, ENGINEERING AND CONSTRUCTION FOR THE PETROLEUM REFINING AND IRON AND STEEL INDUSTRIES

McKee Engineering

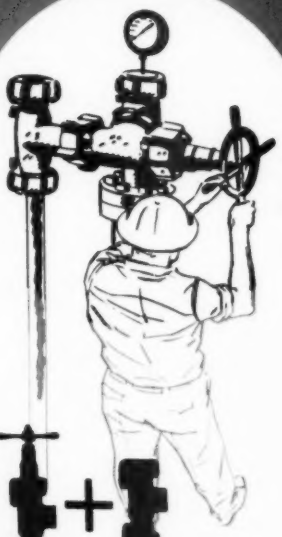
Arthur G. McKee & Company • Established 1905

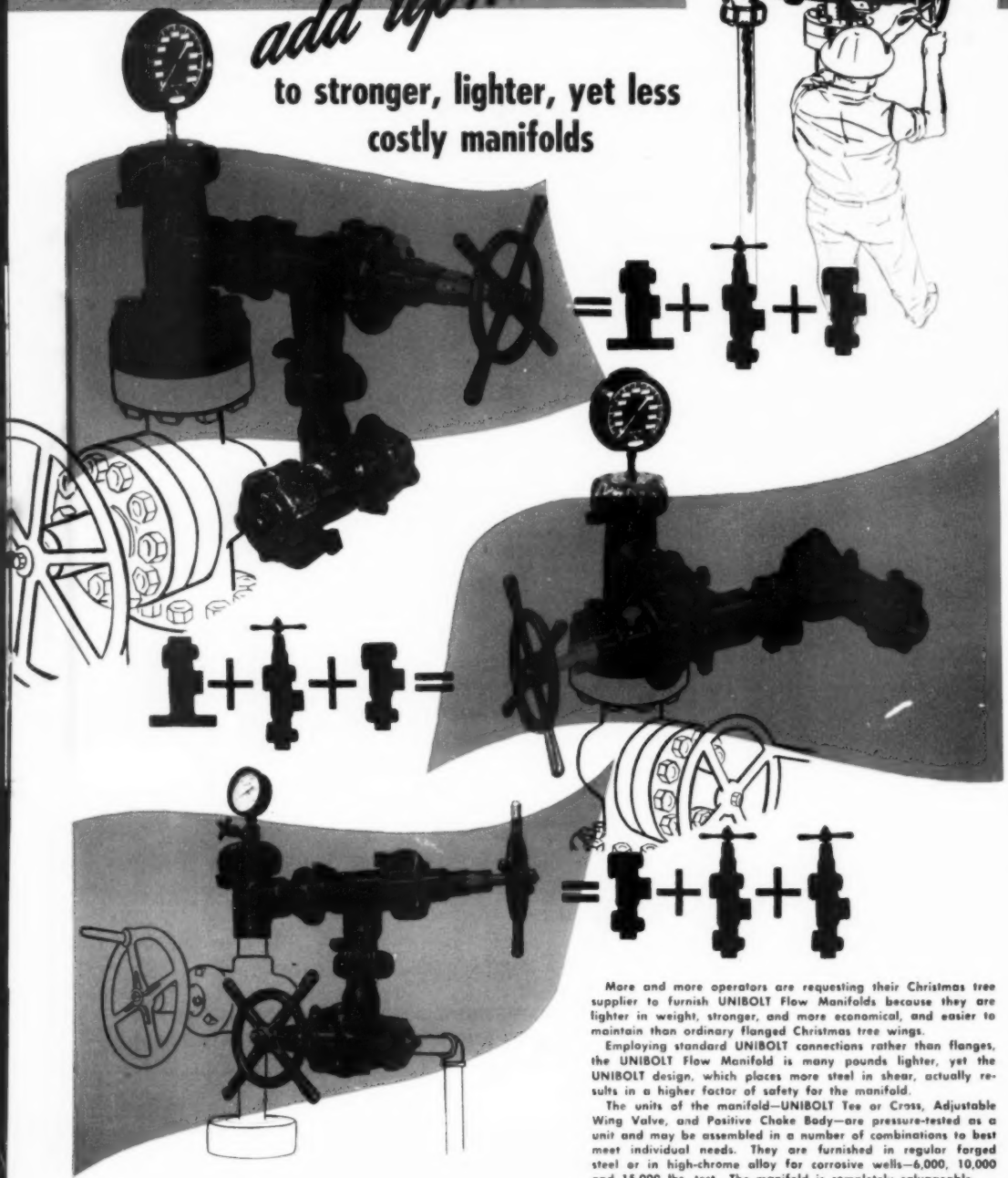
Headquarters: McKee Building, 2300 Chester Avenue, Cleveland 1, Ohio. *New York:* 30 Rockefeller Plaza, New York 20, N. Y. *Tulsa:* 2803 West 40th Street, Tulsa 7, Oklahoma. *England:* The Iron and Steel Division of Arthur G. McKee & Company, is represented by Head, Wrightson & Co., Ltd.

Unibolt Christmas Tree Fittings

add up...

to stronger, lighter, yet less costly manifolds





More and more operators are requesting their Christmas tree supplier to furnish UNIBOLT Flow Manifolds because they are lighter in weight, stronger, and more economical, and easier to maintain than ordinary flanged Christmas tree wings.

Employing standard UNIBOLT connections rather than flanges, the UNIBOLT Flow Manifold is many pounds lighter, yet the UNIBOLT design, which places more steel in shear, actually results in a higher factor of safety for the manifold.

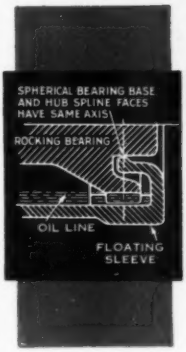
The units of the manifold—UNIBOLT Tee or Cross, Adjustable Wing Valve, and Positive Choke Body—are pressure-tested as a unit and may be assembled in a number of combinations to best meet individual needs. They are furnished in regular forged steel or in high-chrome alloy for corrosive wells—6,000, 10,000 and 15,000 lbs. test. The manifold is completely salvageable.

THORNHILL-CRAVER COMPANY • P. O. BOX 1184 • HOUSTON, TEXAS

NEED "SPECIAL" COUPLINGS?

Koppers Can Help You Save Money With *Easily Modified*

STANDARD Fast's Couplings



FOOLPROOF DESIGN: Instead of perishable oil seals, Fast's use a permanent metal-to-metal closure. Oil is always maintained at a safe level, whether the Fast's is running or standing still!

LOWEST COST: Fast's Couplings cost less per year because they normally outlast the equipment they connect. Original cost can be divided by 20 years or more. As one user says: *"We've had this Fast's Coupling since 1930 . . . it's apparently going to last forever!"* (Name on request.)

NEW DEVELOPMENTS: Fast's were the first gear-type couplings on the market. And they're first again with new designs developed by Koppers—like the revolutionary new Breaking Pin Coupling now available.

IF YOUR coupling problem looks tough—specify Fast's. Then Koppers' engineers can go to work, study your problem, and in many cases find a special coupling is not needed at all. Instead, these coupling specialists can often modify a *standard* Fast's Coupling and save you important money!

Standard Fast's Couplings can be modified for hundreds of unusual applications. Records kept over the past 31 years prove that Fast's Couplings outlast the equipment they connect. Fast's still maintains its original design, without basic change or sacrifice in size or materials.

Don't take chances. Whether your application calls for special or standard couplings, specify Fast's. For full information and specifications, write for your copy of Fast's free catalog today!

KOPPERS

FAST'S

THE ORIGINAL GEAR-TYPE

Couplings

INDUSTRY'S STANDARD FOR 31 YEARS

Mail COUPON TODAY FOR FREE CATALOG!

KOPPERS CO., INC., *Fast's Coupling Dept.*,
380 Scott St., Baltimore 3, Md.

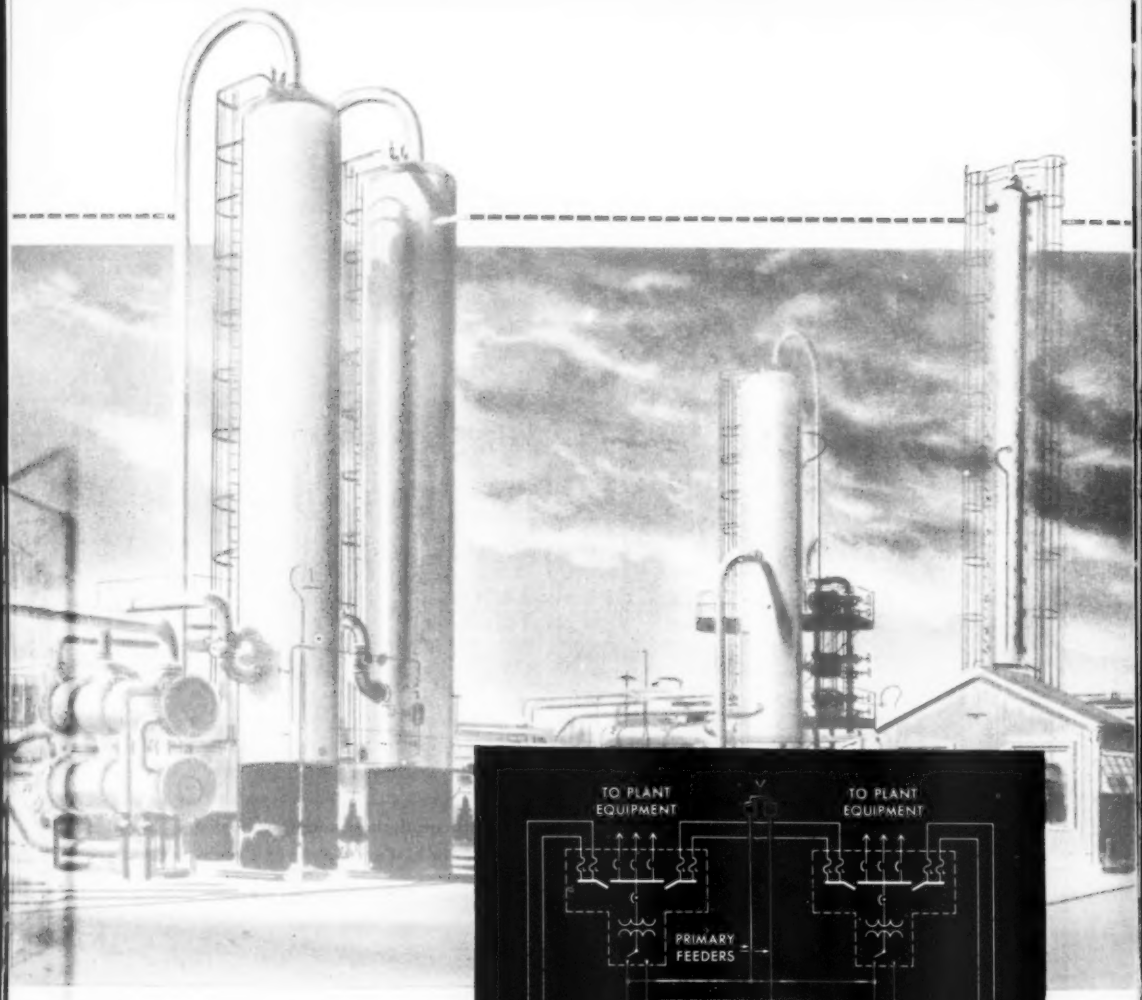
Gentlemen: Send me Fast's Catalog which gives detailed descriptions, engineering drawings, capacity tables and photographs.

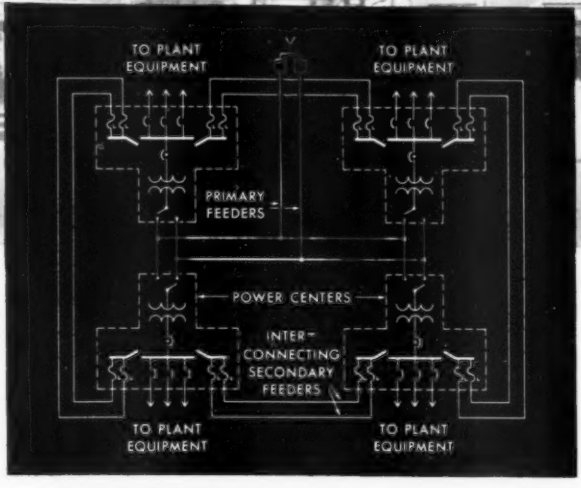
Name.....

Company.....

Address.....

City.....*Zone*.....*State*.....





PRIMARY SELECTIVE NETWORK SYSTEM

This system rates high on service continuity and flexibility. Two Primary Feeders supply power. If a fault occurs on one, the other Feeder takes over to keep service continuous. If a fault occurs in a Power Center, its section of the plant is supplied by the adjacent Power Centers through the interconnecting Secondary Feeders.

When additional power is needed, one Primary Feeder supplies the plant while a new Power Center is connected to the dead feeder. The plant keeps operating.

This is one of eleven basic systems, all with varying characteristics. Let experienced Westinghouse engineers help you plan the system best fitted to *your* operations.

Westinghouse

EQUIPMENT FOR THE PETROLEUM INDUSTRY

YOU CAN BE **SURE**.. IF IT'S

Westinghouse

HOW MUCH DOES IT COST

when a distilling column goes "down"?

Probably more than you care to think about. But when power failure is at fault this costly threat can be eliminated. The answer:

A planned power distribution system!

When you modernize existing plants or build new ones, plan a system that *insures* service continuity . . . that gives you *alternate* power routes when electrical troubles occur. Moreover, make sure the system will be flexible . . . to permit load shifts and allow expansion without shutdown.

The Primary Selective Network shown on the opposite page is an example of a system that gives you this important service continuity and flexibility. But this is just one of the many systems you'll want to consider. Each has specific advantages depending on your particular operation. And Westinghouse can help you and your plant contractor design the system that *best* fits your requirements.

To help you make preliminary decisions we've prepared informative material covering all systems. Write for yours now. And remember, when you're building or modernizing, call in your Westinghouse engineers. With wide experience in power problems they can help you plan the one best system for your particular operation. J-94855

HERE'S REAL HELP FOR YOUR SYSTEM PLANNING

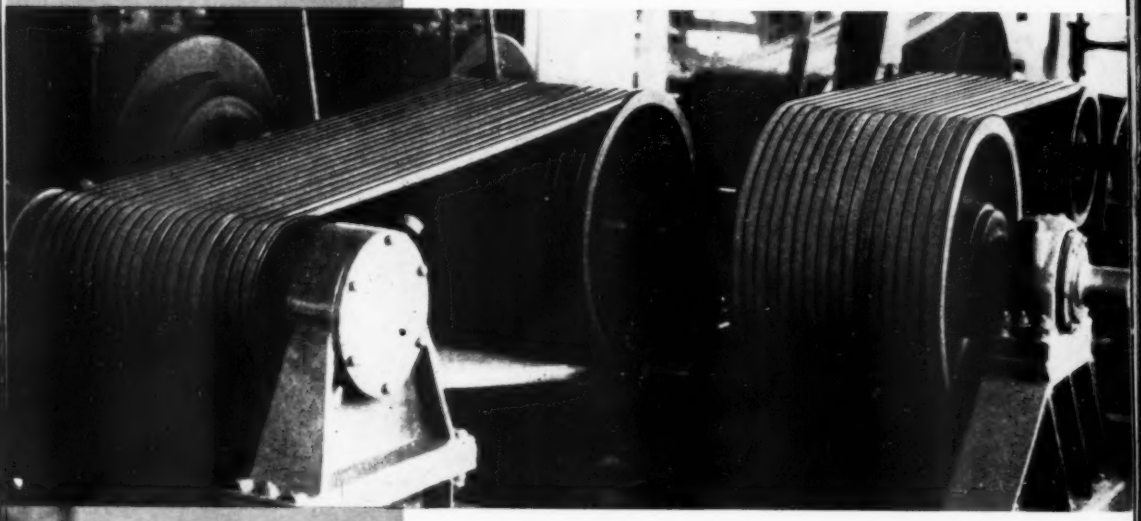
"Industrial Plant Distribution Systems": 34 fact-filled pages completely explain the eleven basic systems. Ask for B-4045.

A System Selector: pocket-sized selector card quickly shows the characteristics of each type.

A Full-Color Movie: sound movie dramatizes the economies of system planning. Ask your Westinghouse representative for a free showing.

Get this valuable information now. Call your Westinghouse office or write: Westinghouse Electric Corp., P. O. Box 868, Pittsburgh 30, Pa.

WHAT IS THE NAME OF THAT "V" BELT THAT GIVES SUCH WONDERFUL SERVICE?



Republic Hose, Too!

It's REPUBLIC RUBBER

. . . but you won't have to remember. Outstanding products are automatically a part of our ONE STOP supply service.

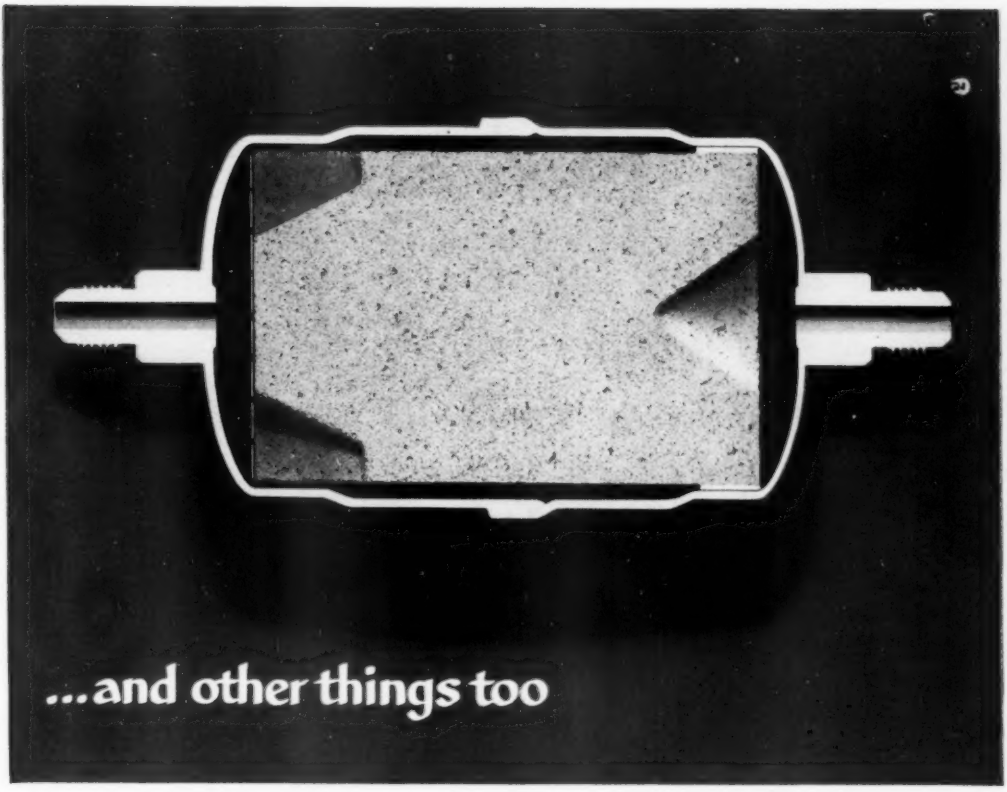
AMERICA NEEDS SCRAP TO MAKE MORE STEEL

Jones & Laughlin Supply Company

J&L STEEL
Subsidiary of Jones & Laughlin Steel Corporation

EXPORT: 405 Lexington Avenue, New York, N. Y., U.S.A.
General Offices: TULSA, OKLAHOMA
82 STORES • 17 OFFICES • 6 RESIDENT SALESMEN

The inside story on drying refrigerants



Continually maintaining a *dry* refrigerant is essential to the operation of any refrigeration system. But *how much* moisture is removed is far less important than *how little* is left—even a drop of water can cause expensive breakdowns. An exceptionally efficient drying agent—such as ALCOA *Activated* Alumina—is required for such an exacting job.

That's why Sporlan Valve Company, St. Louis, Mo., put ALCOA *Activated* Alumina inside their Catch-All Filter-Drier, illustrated above. Molded of granulated alumina, the unique porous core dries refrigerants to an end point so low that any remaining moisture is harmless. Moreover, it cannot channel or powder because ALCOA *Activated* Alumina is a thoroughly reliable, non-corrosive drying agent that will not change its form or properties—will not swell, soften or disintegrate.

Helping to keep refrigerators cold is only one of many jobs ALCOA *Activated* Alumina is doing successfully. Its desiccating properties are finding widespread application in the chemical, food, pharmaceutical and petroleum industries, in air conditioning, and for the maintenance of transformer and lubricating oils.

You should be taking advantage of the economies offered by ALCOA *Activated* Alumina. We'll gladly send you additional information. Write to: ALUMINUM COMPANY OF AMERICA, CHEMICALS DIVISION, 618K Gulf Building, Pittsburgh 19, Pa.

Alcoa Chemicals

ALCOA ALUMINAS and FLUORIDES

ACTIVATED ALUMINAS • CALCINED ALUMINAS • HYDRATED ALUMINAS • TABULAR ALUMINAS • LOW SODA ALUMINAS ALUMINUM FLUORIDE • SODIUM FLUORIDE • SODIUM ACID FLUORIDE • FLUOBORIC ACID • CRYOLITE • GALLIUM

WHEREVER ENGINES WORK

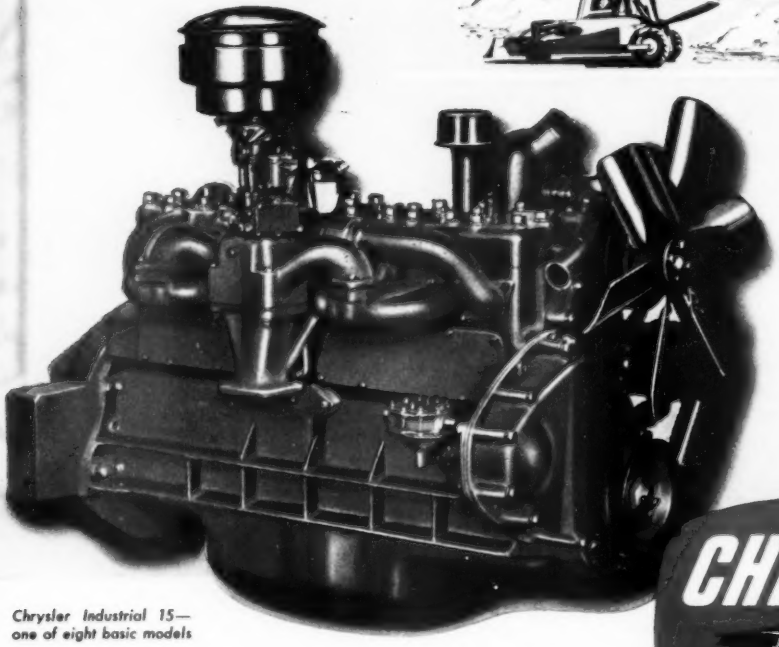
In Construction, Chrysler Powers
Ditching Machines • Cranes • Truck Mixers • Shovels • Loaders • Yarders • Concrete Mixers • Road Pavers • Crane Carriers • Scoop Tractors

In Industry, Chrysler Powers
Air Compressors • Hoists • Derricks • Pumps • Generators • Tractors • Arc Welders • Baling Machines • Conveyors • Tackle Blocks • Winches

Chrysler Industrial Engines Do a Better Job at Lower Cost!

In Farming, Chrysler Powers
Tractors • Combines • Gang Mowers • Spreaders • Irrigation Equipment • Orchard Sprayers • Hay Choppers • Pumps • Feed Mills • Sprinklers

In Other Fields, Chrysler Powers
Locomotives • Motor Coaches • Air Conditioning Equipment • Pulp Machines • Drilling Equipment • Fire Pumps • Snow Plows • Street Flushers • Saw Mill Equipment • Oil Well Pumps and Drillers



Chrysler Industrial 15—one of eight basic models

More manufacturers, more operators of industrial equipment are discovering the brilliant efficiency of Chrysler Industrial Engines on scores of different applications.

For Chrysler Industrial Engines are built *solely for industrial jobs.* Furthermore, Chrysler Industrial Engines are designed and engineered to meet the *specific working requirements* of each type of equipment they power. They can also be adapted to special regional operating conditions.

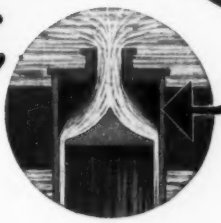
A letter of inquiry will bring an engineer well qualified to discuss your particular application. Address: *Industrial Engine Division, Chrysler Corporation, Detroit 31, Michigan.*

CHRYSLER

HORSEPOWER WITH A PEDIGREE

Dirty Water can't "Shut-down"...

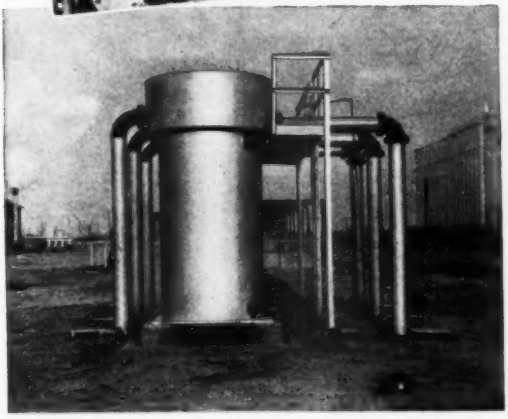
Vogt



film type exchangers

(Condensers—Coolers—Evaporators)

Patent Nos. 1,935,270 - 2,057,597 - 2,424,441



River water, well water or brackish water are all alike to this exchanger *because it can be cleaned* while in operation! The water distributing ferrules need only be removed successively for the cleaning brush or tool whereby the tubes receive additional water which sluices away the dislodged dirt.

Vogt Film Type Exchangers are operating with real economy of first cost, operation and maintenance in power, petroleum, and chemical industries. They serve as Jacket Water Coolers, Feed Water Heaters, Hydrocarbon Evaporators, Sulphuric Acid Coolers, and Sulphur Dioxide Condensers, and can be designed to cool or heat any liquid and to condense or evaporate any fluid.

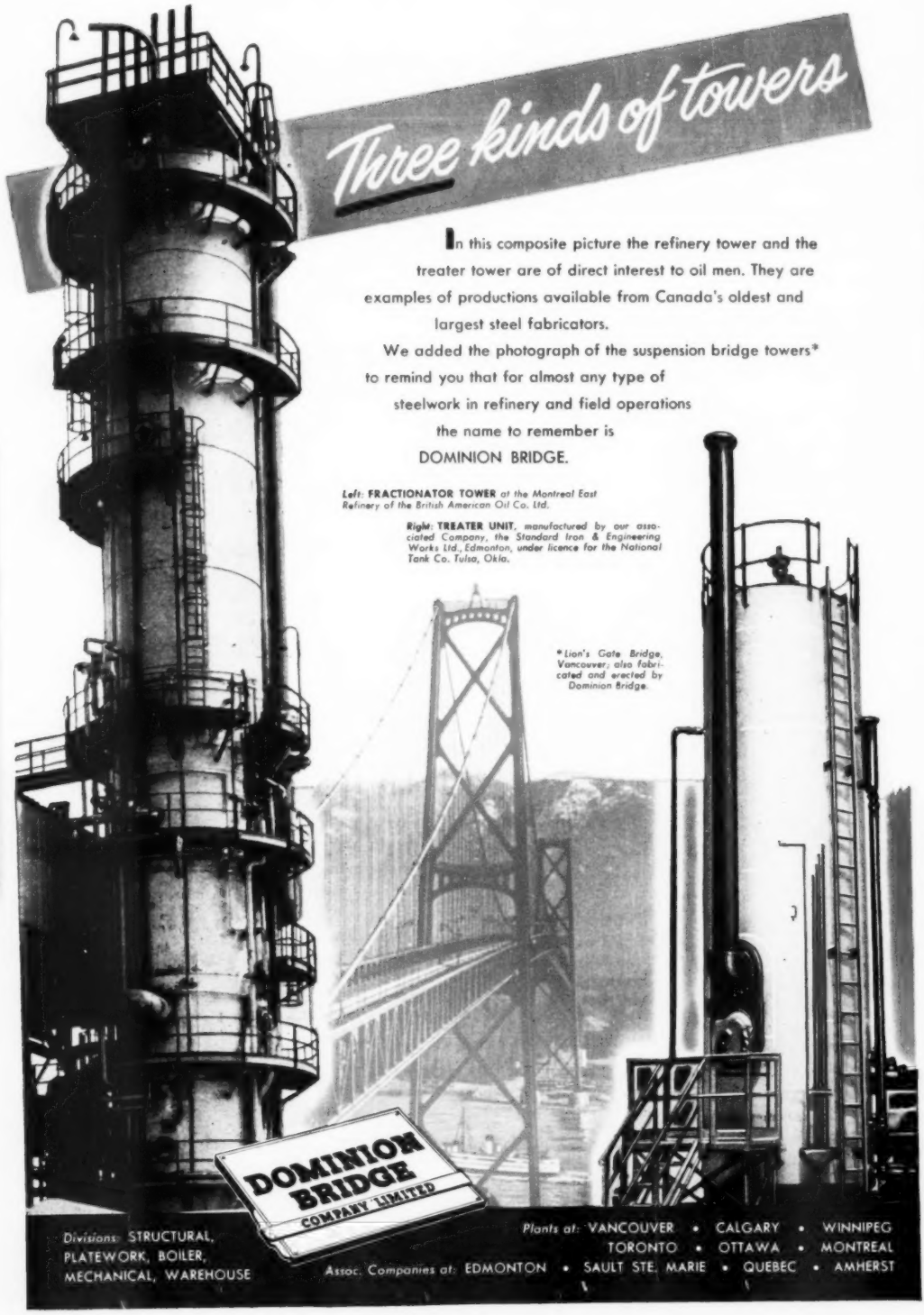
TOP: *Four units at Newton Falls, Ohio Municipal plant cool water for diesel engines and a lubricating oil cooler.*

BOTTOM: *Jacket Water Coolers serving engines of 7,300 HP in the compression plant of a Western Oil Refinery.*

[Bulletin HE-7 describes typical installations of Vogt Film Type exchangers and is available upon request.]

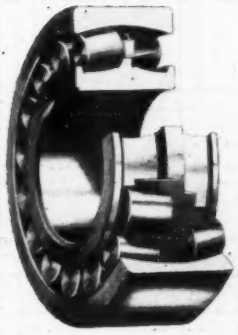
HENRY VOGT MACHINE CO., LOUISVILLE, KY.

Branch Offices: NEW YORK, CHICAGO, CLEVELAND, DALLAS, PHILADELPHIA, ST. LOUIS, CHARLESTON, W. VA.


Three kinds of towers
In this composite picture the refinery tower and the treater tower are of direct interest to oil men. They are examples of productions available from Canada's oldest and largest steel fabricators.
We added the photograph of the suspension bridge towers* to remind you that for almost any type of steelwork in refinery and field operations the name to remember is
DOMINION BRIDGE.
Left: FRACTIONATOR TOWER at the Montreal East Refinery of the British American Oil Co. Ltd.
Right: TREATER UNIT, manufactured by our associated Company, the Standard Iron & Engineering Works Ltd., Edmonton, under licence for the National Tank Co. Tulsa, Okla.
*Lion's Gate Bridge, Vancouver; also fabricated and erected by Dominion Bridge.
DOMINION BRIDGE COMPANY LIMITED
Divisions: STRUCTURAL, PLATEWORK, BOILER, MECHANICAL, WAREHOUSE
Plants at: VANCOUVER • CALGARY • WINNIPEG TORONTO • OTTAWA • MONTREAL
Assoc. Companies at: EDMONTON • SAULT STE. MARIE • QUEBEC • AMHERST

workhorse of the deep drilling rig

...mounted on Torrington Bearings



When the drilling gets deep, all 1600 horsepower of the Brewster N-12 Drawworks are kept busy—driving the drill-string, lowering casing into the hole and moving heavy equipment. Torrington Spherical Roller Bearings on the drum and line shafts of the N-12 help this workhorse stay on the job, hour after hour, with little time out for maintenance.

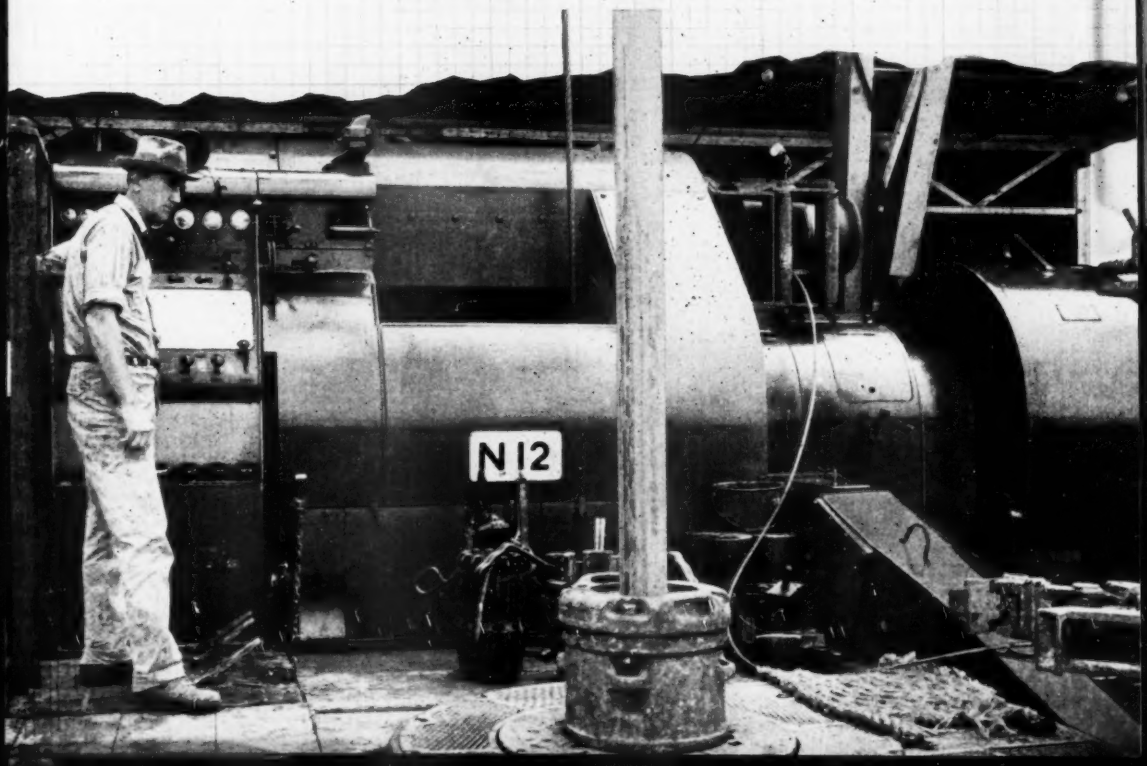
Spherical Roller Bearings automatically compensate for shaft deflections caused by shock loads . . . eliminate binding stresses that limit bearing life. The tremendous capacity of these heavy-duty bearings assures smooth operation under the roughest conditions.

Why not find out what the advantages of Torrington Spherical Roller Bearings can do for your heavy-duty equipment? Our engineers will be glad to assist you.

THE TORRINGTON COMPANY
South Bend 21, Ind. Torrington, Conn.
District Offices and Distributors in Principal Cities of United States and Canada

TORRINGTON *SPHERICAL ROLLER* **BEARINGS**

SPHERICAL ROLLER • TAPERED ROLLER • STRAIGHT ROLLER • NEEDLE • BALL • NEEDLE ROLLERS



LIFE-LINESTARTER . . . provides dependable control and positive overload protection.

1 **AB CIRCUIT BREAKER** . . . assures positive, tamper-proof circuit protection.

2 **LIGHTNING ARRESTER** . . . protects both starter and pumping motor.

3 **TIME SWITCH** . . . converts control to automatic operation for cycle pumping.

Proper Control...

key to improved pumping efficiency

The cost of operating your oil wells is in the hands of your pumping motor controls. Properly designed controls can cut: maintenance time, unnecessary idle time, down time due to equipment failure . . . can increase dollar return.

Take cycle pumping for instance. The time switch on a Westinghouse Oil Field Pumping Control handles this operation automatically. This switch provides for one or more periods of pumping, with intervening periods of shutdown during a 24-hour period. It also provides for one or more full days of shutdown during a week, which may be grouped or spaced throughout the week as desired.

Then there's protection. To be good it must be complete. You get three-way protection with this Westinghouse Pumping Control . . . protection against overloads, faults, lightning. The Life-Linestarter® with its simplified design provides positive overload protection through its snap-action, bimetallic disc-type overload relay. Westinghouse AB Circuit Breaker takes care of fault protection . . . has an interrupting capacity of 15,000 amperes at 600 volts . . . eliminates single phasing replacement and maintenance problems common to fuses. Built-in lightning arrester dissipates lightning surges and static charges . . . protects both the starter and pumping motor.

Every component of this Westinghouse Pumping Control aids in improving the efficiency of your oil well pumping. Compare them yourself.

Get the complete story. Ask for a copy of Westinghouse Electrified Oil Well Pumping, B-4039. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

J-21649

YOU CAN BE SURE.. IF IT'S
Westinghouse
Life-Line
MOTORS and CONTROLS

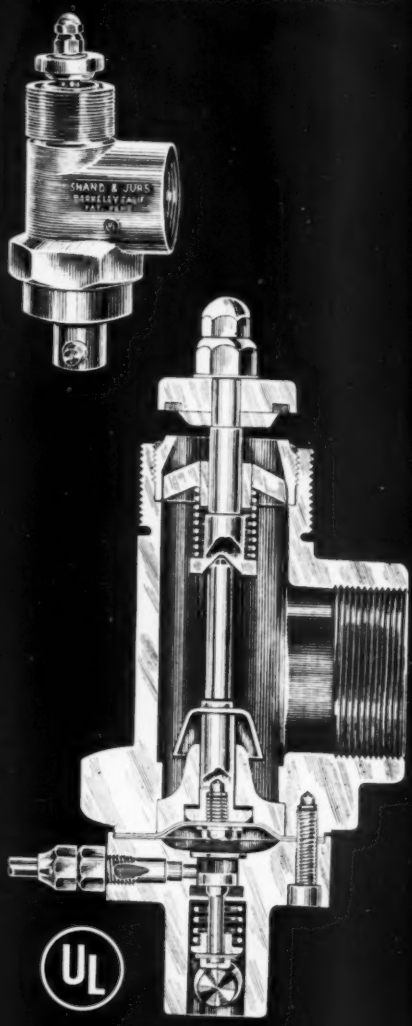
S&J

Announces New

SAFETY VALVE FOR LP-GAS TRUCK TANKS

"SAFETIFLO" the new, revolutionary Internal Safety Valve for LP-Gas truck tanks provides even greater safety in the delivery of LP-Gas than the commonly used excess flow check and shut-off valves, which it is designed to replace. Should an accident tear away or rupture the delivery line or hose, the "Safetiflo" automatically closes . . . and stays closed under constant spring force and internal tank pressure. "Safetiflo" is the SAFE Internal Valve for LP-Gas delivery trucks, as attested by its listing by Underwriters' Laboratories, Inc.

Developed jointly by Phillips Petroleum Company and S&J, "Safetiflo," S&J Fig. 13980, has had over five years extensive field testing. The cast steel body is provided with a weakness groove, and with the two-piece operating stem, permits complete or partial break-off of the valve at the tank outlet, without impairing valve closure or reducing safety. If you want to make your LP-Gas deliveries faster and safer, contact the nearest branch office listed below or the S&J factory for additional information on the new "Safetiflo" LP-Gas valve.



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Shand and Jurs Co. 8TH AND CARLTON STREETS : BERKELEY : CALIFORNIA

NEW YORK 295 Madison Ave. CHICAGO 10409 S. Western Ave. HOUSTON 827 M & M Bldg. TULSA 310 Thompson Bldg. LOS ANGELES 714 W. Olympic Blvd. SEATTLE 3000 Western Ave.

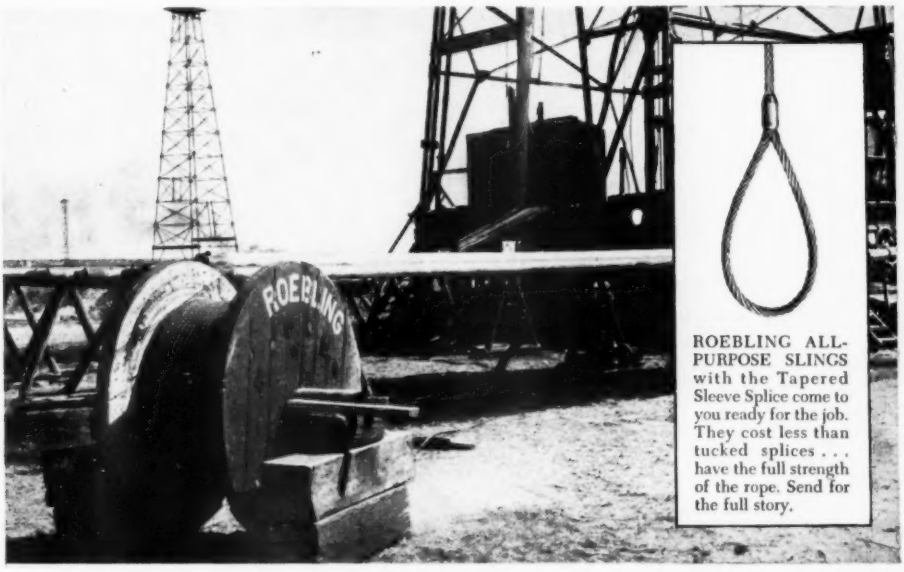
MONTREAL, QUE., 360 Notre Dame St. West VANCOUVER, B. C., 530 Beatty St. FORT ERIE, ONT. DARLINGTON, ENG. CARACAS, VEN.

WIRE ROPE

You'll get more efficient, economical service with ROEBLING rope

TIME AND DOLLAR SAVINGS are more important than ever in the oil fields. One sure way to save time and cut costs is to specify Roebling Preformed "Blue Center" Steel Wire Rope. Here's a tough rope that stands up under shocks, strains and high speeds. Its preforming assures maximum handling ease, better spooling and smooth performance.

Roebling makes a full line of wire rope. Have your Roebling Field Man recommend the *right* ropes for your requirements. And for longest life on the job, get his advice on the correct use and maintenance of wire rope. It is based on experience with thousands of installations. John A. Roebling's Sons Company, Trenton 2, New Jersey.



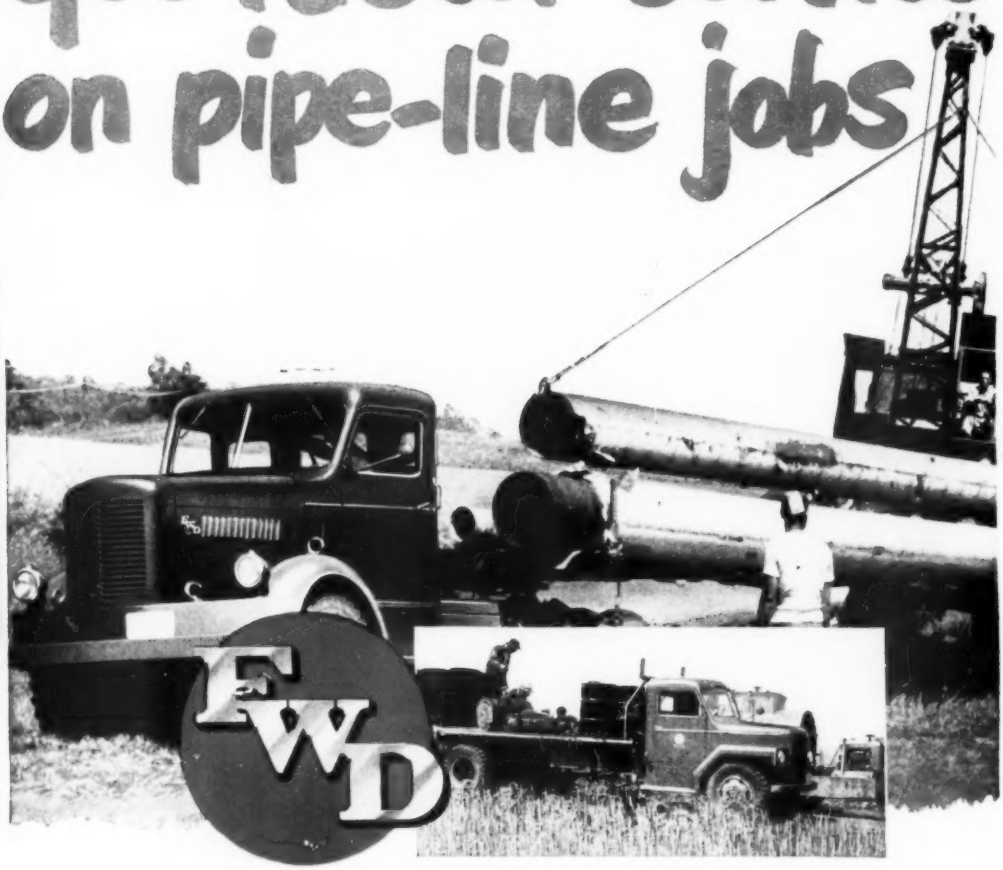
ROEBLING ALL-PURPOSE SLINGS with the Tapered Sleeve Splice come to you ready for the job. They cost less than tucked splices . . . have the full strength of the rope. Send for the full story.

ROEBLING

DISTRIBUTED BY THE NATIONAL SUPPLY COMPANY
REPUBLIC SUPPLY COMPANY

Choose MORE than a truck . . .

Choose an FWD, get faster service on pipe-line jobs

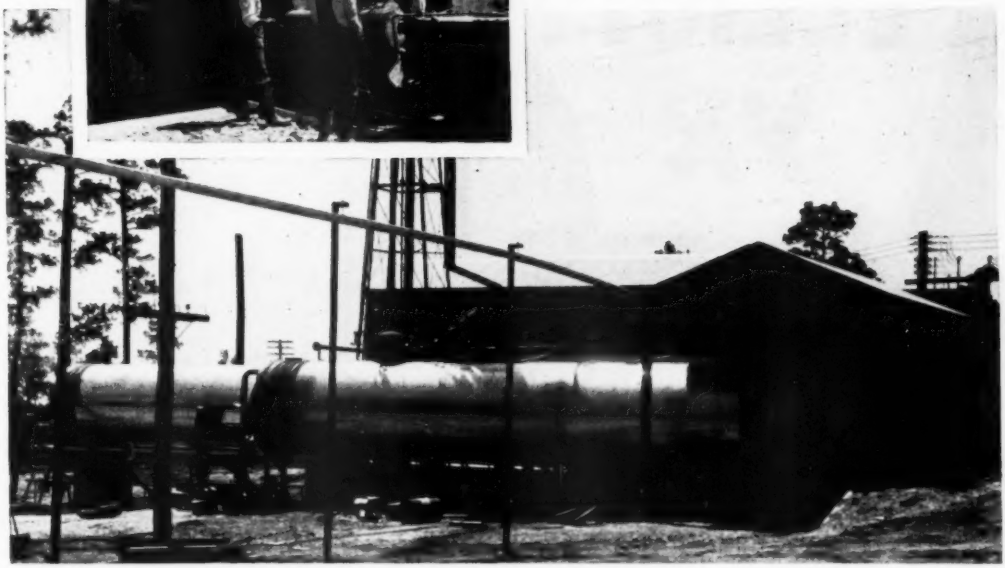


Pipeliners discover that choosing FWDs brings important advantages unmatched by either conventional trucks or conversions. First, of course, FWD gives them outstanding performance over all terrain. But FWDs offer BIG EXTRAS . . . including *up to twice* the truck life . . . far less down-time; lower repair costs; more reliable, faster crew service . . . extra safety for men and equipment *on or off* the highway. All these dollar-saving advantages are created because FWDs have the proper distribution of load and power—which *minimizes stress* and furnishes *extra traction* so important in pipe-line work.

To meet your needs, there are FWD models from 14,500 to 60,000 lbs. GVW—4 and 6 wheel drives. For full facts see your nearby FWD Distributor or contact FWD. The Four Wheel Drive Auto Co., Clintonville, Wis. *Canadian Factory:* Kitchener, Ontario. World-wide sales and service.

America's Foremost Heavy-Duty Truck

TEMPERATURES OF 200°F. TO 359°F. are essential for the pressure-treating of products at the Southern Pine Lumber Company, Diboll, Texas. FOAMGLAS, finished with aluminum sheeting, insulates the horizontal treating cylinders used in the process. Insulation Contractor—The Aber Company, Inc., Shreveport, La.



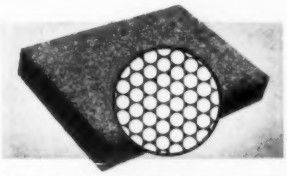
Working under pressure . . . but Hot!

FOAMGLAS . . . THE CELLULAR GLASS INSULATION

● It takes a really rugged material to insulate these treating cylinders, where lumber products are pressure-treated at extremely high temperatures. But FOAMGLAS is handling the job successfully—and economically—because of its unique physical properties.

Its cellular structure gives FOAMGLAS exceptional insulating ability, which it *retains* indefinitely. Its high compressive strength resists crushing and breakage. Its inherent resistance to moisture and vapor minimizes the need for expensive weather protection. Its durability practically eliminates costly maintenance and replacement.

Find out now why so many satisfied users say FOAMGLAS is the most effective and economical insulation, not only for tanks, but also for pipe lines, towers and process equipment. Write for a sample of the material and a copy of our latest booklet. They're both free.



The best glass insulation is cellular glass. The only cellular glass insulation is FOAMGLAS. This unique material is composed of still air, sealed in minute glass cells. It is light weight, incombustible, vermin-proof. It has unusually high resistance to moisture, chemicals and many other elements that cause insulation to deteriorate.

PITTSBURGH CORNING CORPORATION
PITTSBURGH 22, PA.

PITTSBURGH PC CORNING

FOAMGLAS® *the cellular glass insulation*

When you insulate with FOAMGLAS . . . the insulation lasts!

Pittsburgh Corning Corporation
Dept. DD-101, 307 Fourth Avenue
Pittsburgh 22, Pa.

Please send me without obligation a sample of FOAMGLAS and your FREE booklet on the use of FOAMGLAS for Piping and Process Equipment.

Name .....

Address .....

City ..... State .....

ELLIOTT YR

.. the turbine that will fit in anywhere!

- True centerline supports
- Readily removable packing cases
- Sealed bearings
- Sealed governor
- Balanced double-seated valves
- Economical liner type bearings

Tailored to suit the actual requirements of your application because of the wide range of permissible modifications available to the basic design. These include speed governors, pressure governors, location of exhaust, auxiliary controls, etc.—all combined with spark-proof and totally enclosed construction. Write for fully descriptive bulletin.

H-725

ELLIOTT COMPANY

STEAM TURBINE DEPT., JEANNETTE, PA.

PLANTS AT

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Do all this with *One* OXWELD Trade-Mark Blowpipe

- **Cut steel up to 12 in. thick**
- **Bevel parts for fabrication or repair**
- **Gouge grooves of many sizes and contours**
- **Deseam semi-finished steel forms**
- **Cut risers and "wash" pads**
- **Prepare plate edges for welding**
- **Remove rivets and pierce holes**
- **Trim plate and structural shapes**
- **Powder-cut stainless steels and other oxidation-resistant metals**
- **Cut guided circles and straight lines**
- **Scrap obsolete equipment for profit**

Whether your work includes one or more than one of these jobs, the OXWELD C-32 Blowpipe will save you time and money. This all-purpose cutting blowpipe, with its wide variety of inexpensive nozzles and attachments, easily handles these jobs—and many others—with outstanding efficiency, speed, and convenience.

Like all OXWELD products, the C-32 is built to give you many extra years of economical and **trouble-free service** under every condition of use. Available in your choice of 3 lengths (20-, 26-, and 32-in.) and 3 head angles (75-, 90-, and 180-deg.) to suit your exact needs. Write or phone today for full information about this cutting blowpipe — or regarding welding blowpipes, regulators, cutting machines, or acetylene generators.

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Chemicals you live by

HOW TO MEASURE AN ECONOMY

One way of gauging the might and vitality of the Southwest's growing economy is to measure its production of basic chemicals such as *chlorine* and *caustic soda*. On that score the Southwest leads every area in the U. S. in expansion of production facilities.

DIAMOND ALKALI with its still growing Houston plant and its plant at Pine Bluff, Ark., is today a major producer of these chemicals in the Southwest. In oil production and refining, in the synthesis of petroleum-based chemicals and plastics and in the needs of many other industries, DIAMOND Chlorine and Caustic Soda play their part. The Southwest is growing and we are growing with it.

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Bicarbonate of soda
Carbon tetrachloride
Caustic soda
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Sodium Silicates
Soda ash
Special chemicals

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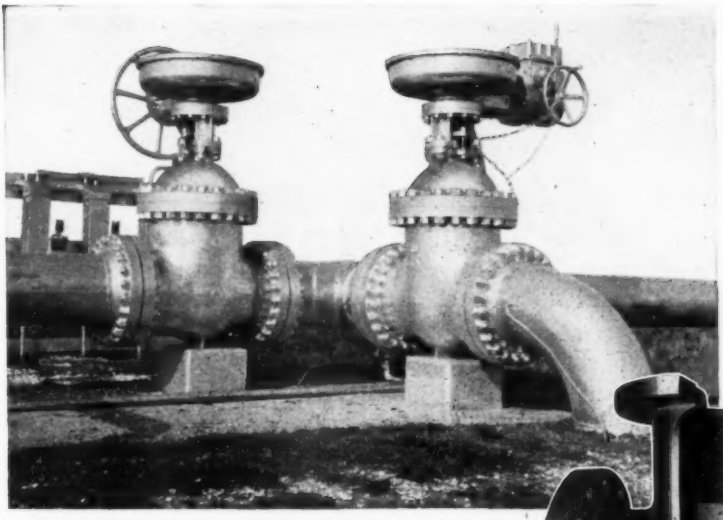
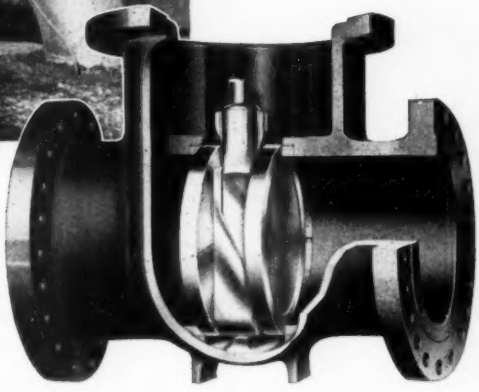
DIAMOND ALKALI CHEMICALS



Darling 20" fully revolving double disc, parallel seat cast steel gate valves, with manually and motor-operated bevel gear, installed on a major line.



Darling cast steel pipe line gate valves

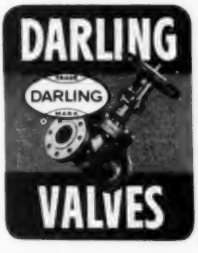
Rated tops at keeping out of trouble!

IT won't cost you a cent to find out *why* you stand to save plenty with Darling pipe line gate valves on the job. Aside from extra rugged, stress-proved construction throughout, it's Darling's unique fully revolving double disc, parallel seat principle that *really* pays off!

Take a close look at the cutaway view. The rugged, self-adjusting wedges *automatically* seat the fully revolving, no-pocket discs, assuring tight, easy closure. Coupled with uniform wear distribution, these valves do a better job and last longer with less attention, less maintenance.

If it's proof of performance you're after, check with some of Darling's pipe line users. Meanwhile, you are welcome to a descriptive bulletin giving *all* the money-saving facts. Darling gate valves are available in all pressures and various constructions for main line, gathering, manifold, tank farm and all other services.

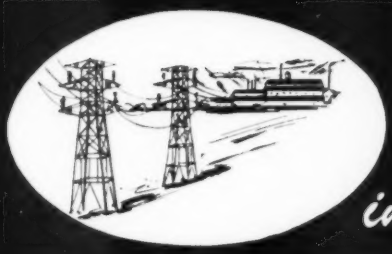
for plus values job-proved again and again



DARLING VALVE & MANUFACTURING CO.

Williamsport 1, Pa.

Manufactured in Canada by Sandilana's Valve Manufacturing Co., Ltd., Galt 19, Ont.



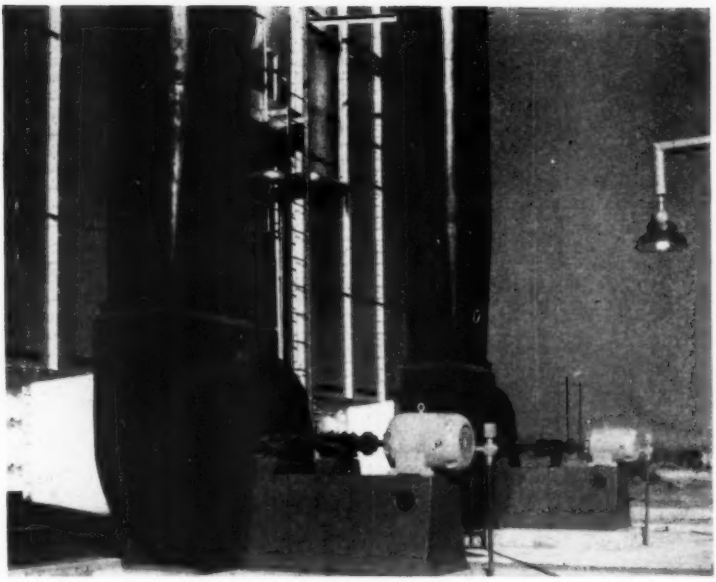
AIR: *As essential as fuel in* POWER GENERATION

THESE

"Buffalo"

INDUCED DRAFT FANS

KEEP THESE BOILERS PRODUCING AT TOP EFFICIENCY



It takes air—a lot of it—to develop the combustion required for modern high pressure steam generation! And "Buffalo" Draft Fans like those above (at a Texas pipe line booster station) are supplying induced draft dependably in the boiler rooms of every essential industry.

For information on efficient Buffalo Forced and Induced Draft Fans, write for Bulletin 3750.

• *Note: "Buffalo" also builds a complete line of centrifugal pumps for industry.*

"Buffalo" FIRST FOR FANS

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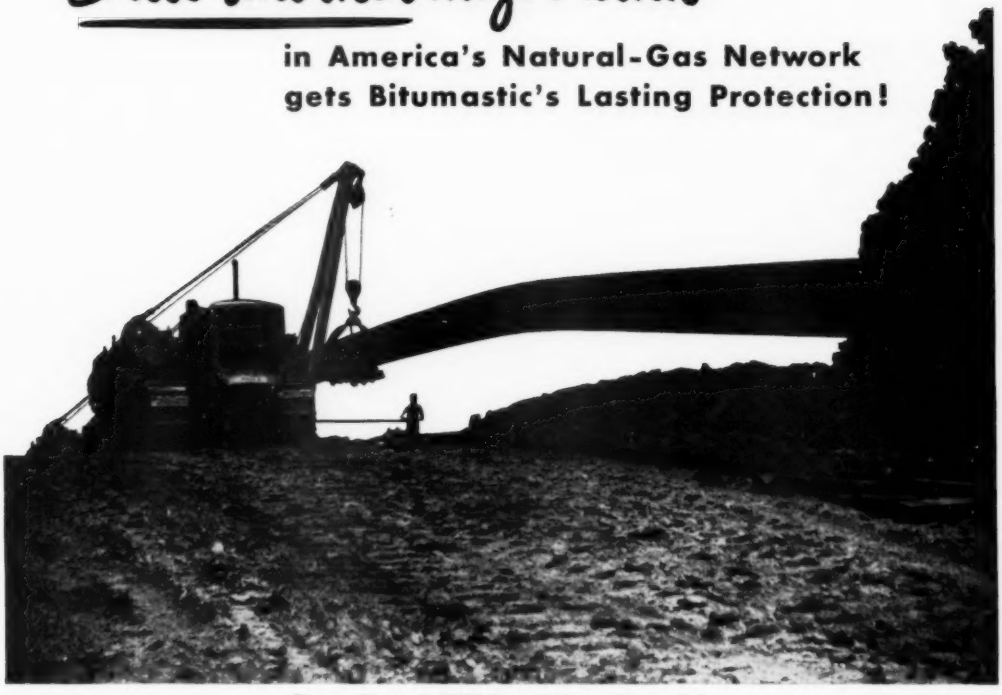
Still another major link

in America's Natural-Gas Network gets Bitumastic's Lasting Protection!



Koppers Bitumastic XXH Enamel being machine-applied

● The southern end of the Tennessee Gas Transmission Company's new line from Kentucky to Buffalo is protected against corrosion by Koppers Bitumastic® XXH Enamel. This extension consists of 373 miles of 26" pipe.

Koppers Bitumastic Enamels have established enviable records in combating corrosion. Under the most severe corrosive conditions . . . in all types of soil . . . under wide variations of temperature—pipe lines protected by Koppers Coatings have been giving good service for twenty and thirty years. And the experience gained by Koppers engineers in protecting these lines can be helpful to you.

Specify "Koppers Bitumastic Enamel" for your next pipe-line project. You'll be getting a protective coating that has been proved by performance. Your Koppers representative will give you complete details and estimates.

Why Bitumastic Enamels give lasting protection

Processed from a base of coal-tar pitch, they are impervious to moisture . . . chemically resistant to soil elements. They make a tight bond with the pipe . . . do not disintegrate with age . . . maintain continuously high electrical resistance.

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REG. U.S. PAT. OFF.

KOPPERS COMPANY, INC., Tar Products Division, Dept. 1003T, Pittsburgh 19, Pa.

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NO. **1050**
Stainless
Steel
Bar Stock
Valve

R-P&C Bar Stock Valves are an achievement of the valve makers' craft. They are precision turned . . . from carefully tested metals . . . and suitable for a wide range of pressures and temperatures . . . for meter, gauge, test, and general purposes.

Rugged construction of R-P&C Bar Stock Valves means long, low-cost, trouble-free service. No better bar stock valves are made. See your R-P&C distributor today or write the nearest R-P&C district office for information.

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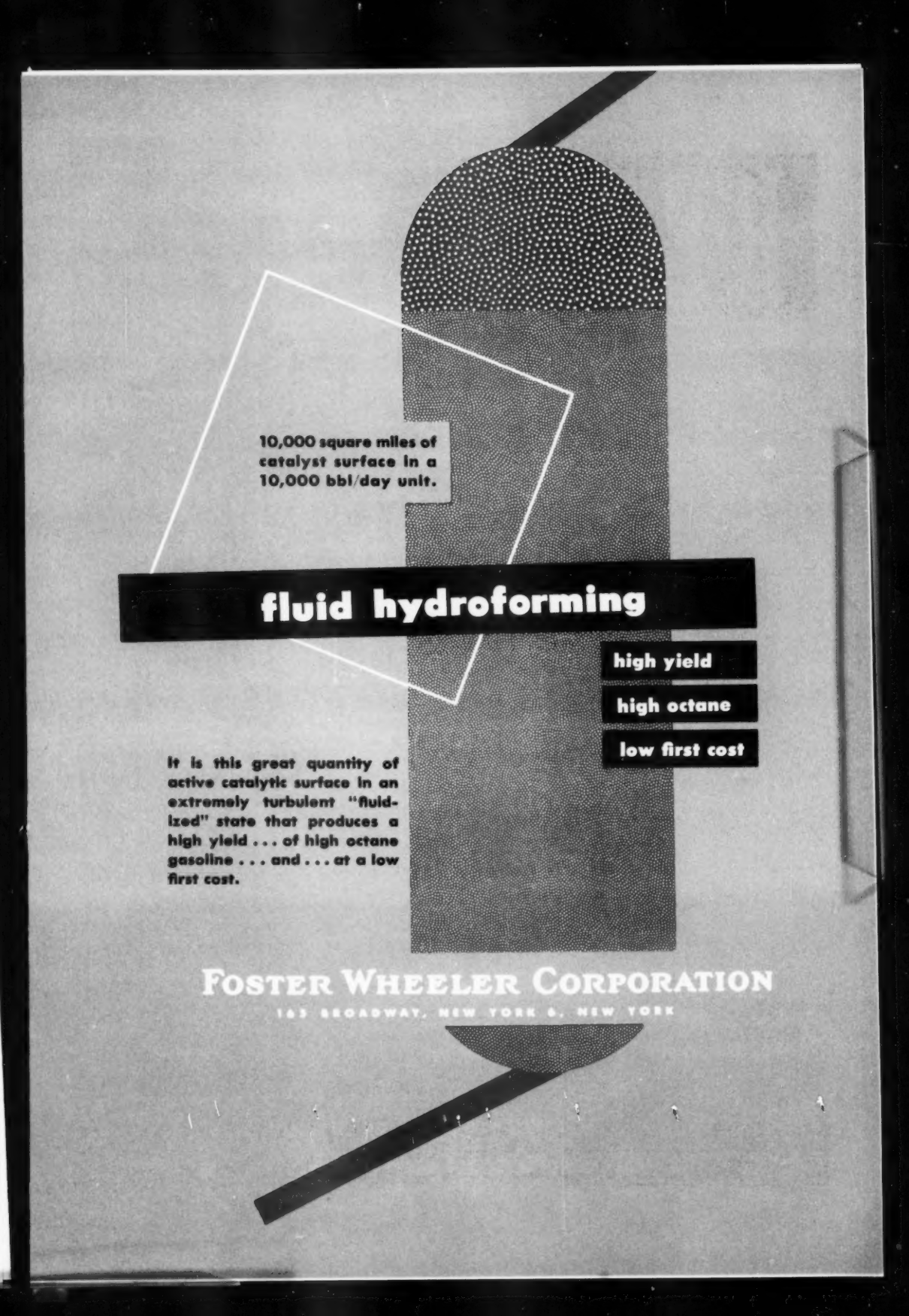
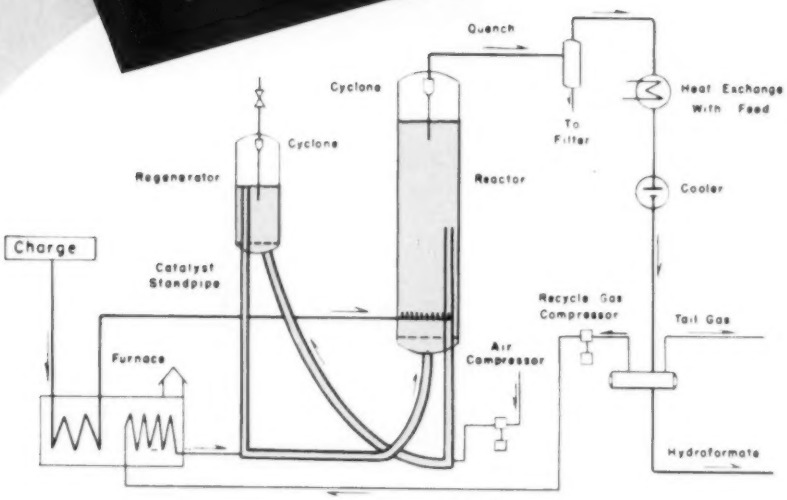
READING-PRATT & CADY VALVES


10,000 square miles of catalyst surface in a 10,000 bbl/day unit.
fluid hydroforming
high yield
high octane
low first cost
It is this great quantity of active catalytic surface in an extremely turbulent "fluidized" state that produces a high yield . . . of high octane gasoline . . . and . . . at a low first cost.
FOSTER WHEELER CORPORATION
165 BROADWAY, NEW YORK 6, NEW YORK

fluid hydroforming



The "fluid" principle, as applied to hydroforming, provides all the distinct advantages of full, continuous operation. Its inherent process variables also makes possible a more exact control of the intensity of the hydroforming reaction.

Foster Wheeler's Fluid Hydroforming Pilot Plant is available for stock evaluation and determination of process design data.

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Gulf Coast Div. Mgr.
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LEE BEGNEAU
District Manager
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Over 21 Years of Field Service . . .

JAMES M. JONES
Sales Representative
Houston, Texas

EDWIN J. MILLER
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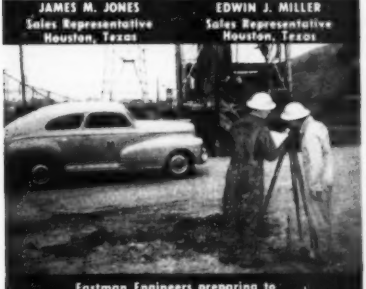
Houston, Texas



Eastman Engineers preparing to run a Multiple Shot Survey

Eastman's 21 years of Specialized Top-Flight Service has resulted in valuable experience in the Gulf Coast Area. Each of Eastman's Gulf Coast Engineers is stationed there because of his knowledge and experience in handling directional drilling problems confronting Gulf Coast Oil Men. These men are specialists and use only precision-built instruments and tools to insure superior work.

Comparison proves the dependable performance of Eastman's Directional Drilling Service . . . Single Shot and Multiple Shot Surveys. Consult Eastman's Gulf Coast Engineers today.

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You can set it, pull it, re-set it—because Guiberson formation packers have that all-important feature of being easy to pull. They break their positive pack-off and come out clean, without swabbing, when you pull the tubing.

This combination of positive pack-off and easy pulling makes Guiberson formation packers ideal for open hole use in holding gas pressure, testing formations, boosting flowing well production, acidizing, re-pressuring or various work-over operations. Where other packers fail —Guiberson gets the job done!

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GUIBERSON FORMATION PACKERS

Type "A" is a single-rubber open-hole formation packer keyed against rotation in all positions.

Type "B" is similar to Type "A" except that a valve is incorporated. Valve is held open by sheer plugs running in; opens automatically when pulling.

Type "C" is a two-rubber packer with more than 50 inches of rubber to assure positive pack-off in even the roughest hole. Valve-equipped.

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Good for Utah

"Standard Oil Co. of California and its subsidiaries are currently exploring on all sides of Salt Lake in Utah, and also in western Colorado, southwestern Wyoming, southern Idaho, and eastern Nevada. Of these areas, the Uinta basin looks most promising at this time, and may develop into a major source of crude oil for the western states. However, the success of this area seems right now to be indeterminate. Some of the conditions there make it seem doubtful. On the other hand, it could become one of the nation's large petroleum reserves. . . ."

"This activity favorably affects the economy of the State of Utah. Development of an oil country means more jobs, more payrolls, more roads, more population. Almost every section of business life in the state is favorably affected by successful oil developments."

R. G. Follis, chairman of the board, Standard Oil Co. of California.

Oil for Economic Recovery

"Whether Western Europe will be a strong ally or a weak one depends in large part on whether it gets the oil products necessary for its economic recovery. And if that oil isn't available from the Middle East, we probably would attempt to supply as much as possible from our side of the Atlantic. The strength of our friends

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GO HYDRO-SHEAVE!

On one installation, an inexpensive Twin Disc HYDRO-SHEAVE Drive reduced peak wattage demand from 3,000 watts to only 2,000 watts, just one benefit reported by the owner.

A Twin Disc HYDRO-SHEAVE Drive delivers full motor torque at all times. Yet, it keeps peak *current surges off the line.* That's because the "slip" of the hydraulic fluid at low rpm permits the motor to accelerate fast to working torque and so pick up the load *smoothly.*

Moreover, the *cushioning* effect of the coupling takes strain off polish rods and gear boxes. With these stresses reduced, your equipment lasts longer, your motor doesn't have to work as hard.

A HYDRO-SHEAVE is a packaged unit ready to install in a few minutes. It improves your power factor, saves wear and tear on all the equipment, and often permits you to select a motor on running, instead of starting, requirements.

You've seen what Twin Disc Hydraulic Units can do on your other equipment. Now, try one on your oil pumping drives—motor-driven or engine-driven—for greater economy in production. Write for Bulletin 145-B today.

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Clutches & Hydraulic Drives

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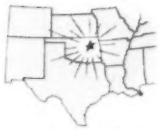
And others we know have had to go as low as 20,000 feet before their drilling was complete

BUT that's the oil business - there's one whale of a lot of differentials

Before you wind up with the essentials AND that's why so many banks throughout



the Southwest always call to us....

For expert advice, credit information, "farm-out" loans, because Oil always has been an easy haul to us!

In fact, as far as service to banks and Oil men even if we do say so-we are very well versed

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in Western Europe is at stake. If necessary, to meet their minimum needs, the U. S. might ration petroleum products in this country."

From the Flying Red Horse, published by Socony-Vacuum Oil Co., Inc., New York.

Both Wrong on Prices

"The people who think that petroleum prices are too high and the people who think the prices are too low cannot both be right. The question naturally arises: which of them is wrong? And the answer is: They are both wrong!

There is no escaping the fact that any attempt to tinker with a free market is bound to create more problems than it solves."

Donald C. O'Hara, attorney, National Petroleum Association, before Ohio Petroleum Marketers Association, Akron.

CALENDAR

October

Institute of Gas Technology, annual meeting, Chicago, October 18.

American Chemical Society and Southern Association of Science and Industry, Southwide Chemical Conference, Wilson Dam, Ala., October 18-20.

National Association of Corrosion Engineers, South Central Region, annual meeting, Corpus Christi, Tex., October 18-20.

American Association of Petroleum Geologists, regional meeting, Commodore Perry Hotel, Austin, Tex., October 18-20.

Natural Gasoline Association of America, southern regional meeting, Blackstone Hotel, Tyler, Tex., October 19.

American Institute of Chemical Engineers, sixth annual South Texas Section technical meeting, Hotel Galvez, Galveston, October 19.

Third Oil Recovery Conference, Cowden Junior High School Auditorium, Midland, Tex., a symposium on the Spraberry trend fields of West Texas, October 19-29.

Independent Petroleum Association of America, Shamrock Hotel, Houston, October 22-23.

Oklahoma Institute of Technology, diesel power-plant operators' conference, Oklahoma A. & M. College, Stillwater, Okla., October 22-25.

American Institute of Electrical Engineers, fall general meeting, Hotel Cleveland, Cleveland, October 22-26.

Fifteenth Penn State Technical Conference on Petroleum Production meeting at State College, Pa., October 24-26.

Society of Exploration Geophysicists, eastern regional meeting, Webster Hall Hotel, Pittsburgh, October 25.

American Institute of Mining and Metallurgical Engineers, petroleum branch, annual meeting of West Coast chapter, Elks Club, Los Angeles, October 25-26.

Society of Automotive Engineers, diesel-engine division, Drake Hotel, Chicago, October 29-30.

National Petroleum Association, joint meeting of Department of Standards and Tests, and Department of Manufacture, Emory Hotel, Bradford, Pa., October 29; and Arlington Hotel, Oil City, Pa., October 30.

National Lubricating Grease Institute, annual meeting, Edgewater Beach Hotel, Chicago, October 29-31.

American Institute of Mining and Metallurgical Engineers, fall meeting of all branches in connection with Mexican Bureau of Mines, Hotel Del Prado, Mexico City, October 29-November 3.

American Society for Testing Materials,

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Liquid-blast
ROCK BITS

"I'm proud of the runs these bits gave us"

...Says L. E. Voss, tool pusher for a prominent Gulf Coast drilling contractor.

Mr. Voss says, "We ran into some mighty hard formations in the Hamshire Field near Beaumont after setting 7" casing, but we made better than average hole with **REED** 2H and 2HS-1W Rock Bits."

S. R. Trammel, driller under Mr. Voss, is a strong booster for **REED** Rock Bits.

REED Liquid-Blast Rock Bits drill hard formations efficiently because jets of drilling fluid quickly wash broken formation from the bottom of the hole. As a result, cutters are always working on new formation—making for fast drilling and good long runs.

For good long runs **use the REED "LB"**

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CAMERON
FORGED STEEL
Superiority

is now available in
low pressure-low price
trees

northern California district, San Francisco, October 31.

Society of Automotive Engineers, fuels and lubricants division, Drake Hotel, Chicago, October 31-November 1.

November

Louisiana-Arkansas Division, Mid-Continent Oil and Gas Association, twenty-ninth annual meeting, Roosevelt Hotel, New Orleans, November 1-2.

American Association of Petroleum Geologists, Society of Exploration Geophysicists, and Society of Economic Paleontologists and Mineralogists, annual joint meeting, Pacific sections, Ambassador Hotel, Los Angeles, November 1-2.

American Petroleum Institute, thirty-first annual meeting, Stevens Hotel and Palmer House, Chicago, November 5-8.

Southwest Research Institute, second conference on coastal engineering, Rice Hotel, Houston, November 7-10.

American Society for Testing Materials, southern California district, Los Angeles, November 8.

Gulf Coast Association of Geological Societies, first annual meeting, Roosevelt Hotel, New Orleans, November 15-17.

Rocky Mountain Oil and Gas Association, annual meeting, Cosmopolitan Hotel, Denver, November 15-17.

Petroleum Electric Power Association, twenty-third annual meeting, Shamrock Hotel, Houston, November 19-20.

Society of Exploration Geophysicists, regional meeting, Baker Hotel, Dallas, November 19-20.

Natural Gasoline Association of America, Panhandle-Plains regional meeting, Herring Hotel, Amarillo, Tex., November 20.

Mid-Continent Oil and Gas Association, annual board of directors meeting, Tulsa Club, Tulsa, November 20.

American Society of Mechanical Engineers, annual meeting, Chalfonte-Haddon Hall, Atlantic City, November 25-30.

Twenty-third Exposition of Chemical Industries, Grand Central Palace, New York City, November 26-December 1.

December

American Institute of Chemical Engineers, annual meeting, Chalfonte-Haddon Hall, Atlantic City, December 2-5.

Chemical Specialties Manufacturers Association, thirty-eighth annual meeting, Mayflower Hotel, Washington, D. C., December 3-4.

Interstate Oil Compact Commission, annual meeting, Hotel Marion, Little Rock, Ark., December 11-12.

American Association for the Advancement of Science, annual meeting, Philadelphia, December 27-28.

1952 Meetings

January

Society of Automotive Engineers, annual meeting, Hotel Book-Cadillac, Detroit, January 14-18.

February

American Society for Testing Materials, Committee D-2 on petroleum products and lubricants, Shoreham Hotel, Washington, D. C., February 3-8.

Missouri Petroleum Association, annual convention and trade exhibit, Jefferson Hotel, St. Louis, February 4-6.

American Petroleum Institute, Division of Marketing, lubrication-committee meeting, Hotel Book-Cadillac, Detroit, February 18-19.

Wisconsin Petroleum Association, twenty-sixth annual convention and equipment show, Milwaukee Auditorium, Milwaukee, February 26-27.

American Association of Petroleum Geologists, Rocky Mountain Section, second annual convention, Salt Lake City, February 28-29.

March

American Society for Testing Materials, spring meeting, Hotel Statler, Cleveland, March 3-7.

American Petroleum Institute, Division of Production, southwestern district, Washington-Youree Hotel, Shreveport, March 5-7.

National Association of Corrosion Engineers, eighth annual conference and exhibition, Galvez Hotel, Galveston, Tex., March 10-14.

American Institute of Chemical Engineers, regional meeting, Atlanta, March 16-19.

American Petroleum Institute, Division of Production, Mid-Continent district meeting, Broadview Hotel, Wichita, Kans., March 19-21.

Western Petroleum Refiners Association, annual meeting, Plaza Hotel, San Antonio, March 31-April 2.

April

American Petroleum Institute, Division of Production, eastern district, Hotel William Penn, Pittsburgh, April 2-4.

Southwestern Gas Measurement Short Course, University of Oklahoma, Norman, April 8-10.

American Institute of Electrical Engineers, District 7 meeting, Hotel Jefferson, St. Louis, April 15-17.

American Petroleum Institute, Division of Transportation, pipe-line conference, Blackstone Hotel, Fort Worth, April 21-23.

American Petroleum Institute, Division of Production, Rocky Mountain district, Gladstone Hotel, Casper, Wyo., April 24-25.

Southern Gas Association, annual convention, Galveston, Tex., April 28-30.

American Institute of Electrical Engineers, District 1 meeting, Binghampton, N. Y., April 30-May 2.

May

American Geophysical Union, thirty-third annual meeting, National Academy of Sciences, National Research Council, Washington, D. C., May 5-7.

American Institute of Chemical Engineers, regional meeting, French Lick, Ind., May 11-14.

American Gas Association, Natural Gas Department spring meeting, Biltmore Hotel, Los Angeles, May 12-13.

American Petroleum Institute, Division of Refining, seventeenth midyear meeting, San Francisco, May 12-15.

American Petroleum Institute, Division of Production, Pacific Coast district, Biltmore Hotel, Los Angeles, May 15-16.

American Petroleum Institute, Division of Marketing, midyear meeting, Copley Plaza Hotel, Boston, May 19-20.

Gas Appliance Manufacturers Association, annual meeting, Broadmoor Hotel, Colorado Springs, Colo., May 21-23.

American Gas Association, production and chemical conference, Hotel New Yorker, New York, May 26-28.

June

Pennsylvania Grade Crude Oil Association, annual meeting, Hotel William Penn, Pittsburgh, June 5-6.

Canadian Gas Association, Chateau Frontenac, Quebec, June 8-12.

American Petroleum Institute, midyear standardization meeting, Brown Palace Hotel, Denver, June 9-14.

American Society for Testing Materials, annual meeting, Hotel Statler, New York, June 23-27.

American Institute of Electrical Engineers, summer general meeting, Hotel Statler, New York City, June 23-27.

NOMADS

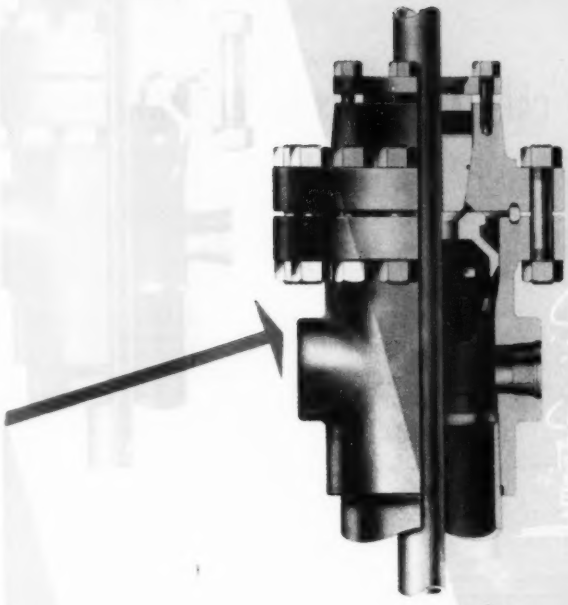
Tulsa Nomads, third Friday of each month. After Five Room, Tulsa Hotel.

Dallas - Fort Worth Nomads, first Monday of each month, Greater Dallas Club.

Houston Nomads, second Monday of each month, Ye Ole College Inn, Houston.

Los Angeles Nomads, second Wednesday of each month, Jonathan Club.

New York Nomads: October 29, regular meetings, Louis Sherry's; December 8, Christmas dinner dance, Hotel Pierre.



CAMERON FORGED STEEL A.P.I. FLANGED TUBING HEAD

best buy in the low-pressure low-price field!

This fine API flanged, forged steel, tubing head is priced comparable to the ordinary tubing heads with threaded upper connections. It eliminates the need for, and additional cost of, an adapter when it is necessary to install a flanged valve or blowout preventer above.

Several types of tubing hangers are available (Type "QC" hanger illustrated). Furnished with lock screws when desired in either Series 400 API, (1000 lbs. w.p.) or Series 600 API, (2000 lbs. w.p.) models.

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JOURNALLY Speaking

Of Boats and Cameras

A VERY sharp-eyed reader is L. I. Freeman of Heiland Exploration Co., Shreveport. He writes:

"The detail carried by the Journal has always been interesting, particularly that shown by the pictures. In your September 20 issue, page 179, either your negative has been printed wrongside or I do not know my boats. Which is it?"

Reader Freeman is right. The picture is reversed. That picture is the cover page introducing a special section of drilling articles, and the negative was "flopped," as the engravers say, on purpose. What was desired was an arty effect rather than to show any particular detail, and we figured the page would have better balance with the derrick on the left instead of on the right as it was in the original photograph.

The technique of reversing a picture is frequently employed in cases like this, and usually a person not familiar with the picture can never tell the difference unless there is something like lettering which shows up backwards. In this instance several of our staff examined the picture with a magnifying glass and could find nothing which would look mirrored if reversed.

Mr. Freeman evidently knows a lot more about boats than us landlubbers up here on the Oklahoma prairies. Even after he called us on it, we couldn't discover any telltale clue in that boat. We were under the impression that some boats are driven, or should we say navigated, from the right—er, starboard—side, and others from the port side. For the life of us we can't see anything wrong with that boat, even though we know a trick of the camera turned it wrongside out. For that matter, we can't see anything wrong with the derrick, with which we, presumably, are more familiar.

Since our readers are checking up on us so closely, we might as well come right out and admit that we used another photographic trick on page 165 of our pipe-line issue, October 4. That really is two pictures, and again the purpose was simply to get a good-looking page. We thought our artist superimposed the one on t'other with such consummate skill that no one could detect the deception, but we expect to get another letter from Brother Freeman any day.

Please understand, Gentle Reader, that our favorite oil publication never indulges in fakery of any sort when picturing an actual oil operation. But when we go in for Art with a capital A we stop at nothing to get a nifty effect.

Man on the Spot

GETTING there firstest with the mostest wins battles and builds publications, and our favorite oil publication is firmly committed to that policy. It pays off, among many other ways, in the lead story in this week's issue.

Last summer when we began talking about sending Dahl Duff to the Middle East we couldn't be sure what the situation would be in Iran when he got there, or even if he would get into Iran at all. But we knew that a lot of oil news was brewing in Iran as well as in other Middle East countries, and that our indefatigable international editor was just the man to cope with any kind of journalistic challenge. So we packed him off with instructions to do whatever seemed necessary and proper.

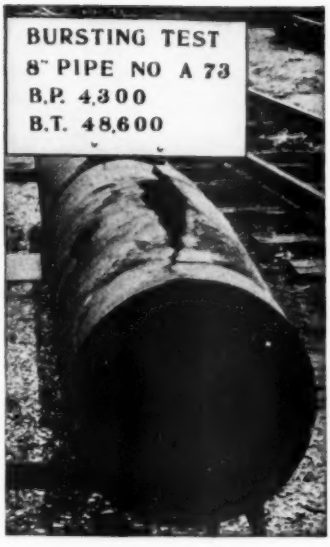
Last week the British moved out of Abadan refinery and Duff moved in, and this week he gives you an eye-witness account of conditions in the hottest spot in the oil world today.

Through the expert eyes of an experienced reporter and oil wri'er he viewed the vast but idle organism that was the largest refinery anywhere. He talked with the Iranian engineers who have taken over the plant, and even found a fellow alumnus of the University of Oklahoma among them. Between the lines of his on-the-spot report Dahl packed hints of the desperate courage born of national pride and self-determination, and of the pathos of the realization of the Herculean task ahead.

There is no substitute for first-hand reporting, and that's what our man Duff is giving. Barring problems of censorship and other hazards of the reporting profession, you will see a lot more of Dahl's reporting ability in coming issues.

Henry D. Ralph.

CRUSHING TEST: Ductile iron pipe sections, tested to fracture in compression, reveal the superior ductility of this new engineering material. Its strength and toughness make ductile iron an excellent material for tubular products. The average ring modulus of rupture on 8" diameter rings so tested by Underwriters Laboratories was 127,650 p.s.i. Photographs shown here were furnished by Lynchburg Foundry Company, Lynchburg, Va.



BURSTING TEST: This 8" diameter pipe was cast in ductile iron, welded with Ni-Rod 55® (nickel welding rod developed for cast iron) and then subjected to bursting tests. Average internal bursting pressure: 4,300 lbs. Average bursting tensile strength: 48,600 p.s.i. All cracks occurred outside of the weld, with no shattering.

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Crude Oil, Natural Gasoline and Liquefied Petroleum Products

Look at Iran

While the oil industry of the United States is devoting this entire week to promoting a better understanding of its operations and a better appreciation by its neighbors, the eyes of the world are on Iran and a tragic example of failure to achieve this sort of understanding and appreciation.

The failure lies with both the British and the Iranians. Neither did enough toward understanding the other. Both failed to appreciate the problems and feelings of the other. Both are suffering for it now.

It is pointless to argue whether or not the British oil operators tried as hard as they could to gain the good will of the Iranians. Obviously their efforts fell short of the mark. The British had the law on their side—the sanctity of contract, the letter of the bond—but not the friendship of those with whom they worked.

The Iranians also are paying the penalty for their lack of understanding of the oil industry. A proud and ancient people with a burning desire for the benefits of Occidental living, they failed to realize their own lack of technical and administrative ability and the complicated skills and problems involved in an oil operation. In one stride they tried to bridge the gap of generations from pastoral to industrial economy.

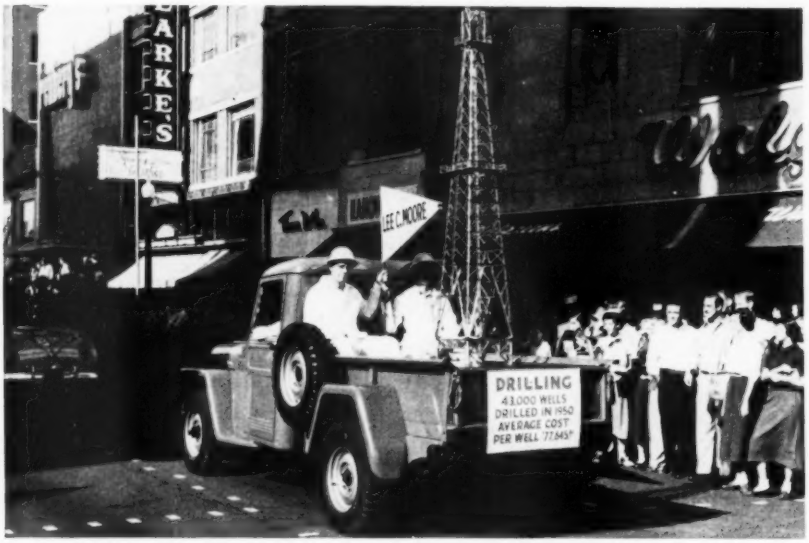
Both parties also, it appears, failed to anticipate the reaction of world opinion, particularly in the United States. The British apparently thought that this country would support them in their legal position and supply them with needed oil during the deadlock, while the Iranians seem disappointed that the country of George Washington has not rallied to support their struggle with the British Crown.

The attitude of the average American oil man, as we interpret it, is that the British were shortsighted in relying on the letter of the law while ignoring public opinion which is the basis of government and of human relationships in Iran as everywhere, and that the United States is under no obligation to strain its resources to aid them now. Also the attitude is that sympathy with Iran's desire to control its own oil and its own destiny does not condone nationalization or confiscation, and that Americans want no part of either economic imperialism or government operation.

The present deadlock in Iran has been called an example of an irresistible force meeting an immovable object. But the history of the American oil industry demonstrates that nationalization is not an irresistible force, nor is economic imperialism an immovable object. Good public relations—in the broad sense and with all that it implies—can dissipate both.

Iran today is a monument to the failure of industry to understand and to make itself understood by the public—its neighbor and its boss. Fortunately, the American oil industry is working intelligently and successfully to achieve such mutual understanding here, and the same forces are at work in other parts of the world.

THIS WEEK



OIL ON PARADE.—In scores of ways and in hundreds of communities the oil industry is telling its story this week. Typical is this football parade in Tulsa where mobile oil displays were interspersed with bands, floats, and convertibles full of sorority queens.

INTERNATIONAL—Dahl Duff, Journal's international editor, tours Abadan refinery on invitation of Iranians, gives first-hand report on what's going on in this vast plant. . . . Witnesses evacuation of British personnel from Iran. . . . ¶Premier Mossadegh of Iran tells U.N. Security Council to keep hands off in its wrangle with Britain over nationalization question. . . . ¶Aramco's air fleet being enlarged to carry out its varied operations.

STEEL—NPA earmarks 1,708,500 tons for petroleum, natural-gas operations during first quarter of 1952, a cut of 98,000 tons. . . . Officials emphasize that first half of 1952, particularly initial 3 months, will be the "toughest" period in the defense program so far as metals are concerned. . . . ¶Spraberry operators question whether suggested changes in spacing pattern would actually save steel as claimed by defense officials. . . .

NATURAL GAS—Natural-gas industry's new activity to level off, at least for a brief period, following enormous postwar expansion program. . . . This trend in the business apparent as leaders discuss problems at annual American Gas Association meeting in St. Louis. . . . ¶Ralph Davis, Houston consultant, predicts Gulf Coast area to see major natural-gas-reserves discoveries in the future. . . .

WASHINGTON—No congressional action anticipated this year on tidelands legislation. . . . ¶Senators investigating 1949 surplus-tanker deal which reportedly returned a $2,800,000 profit on a $100,000 investment. . . . ¶Navy's Bureau of Ships testing new chemical compound designed to raise quality of diesel fuel to Navy requirements without refining now necessary. . . .

INDUSTRY—Phillips Petroleum Co. named winner of 1951 Award for Chemical Engineering Achievement for its work in commercial development of high-abrasion carbon black and cold rubber. . . . ¶Oil-company participation in chemical manufacture aids chemical industry in output of vital products, but latter is plagued with material shortages. . . . ¶Oil Progress Week now being celebrated throughout the nation. . . .

PRODUCTION—Rising stocks, plus success in making up world deficit due to Iranian shutdown, to permit decline from peak oil production in the Southwest. . . . Texas allowable set at 3,005,081 bbl. daily, down 98,184 bbl. daily, for November. . . . ¶Operators, royalty and landowners oppose changing spacing rules for vast Spraberry trend in West Texas. . . . ¶Texaco to start several exploratory tests in Imperial Valley of California. . . .

SECONDARY RECOVERY—Third crop of oil will be assured from Naval Reserve field of Osage County, Oklahoma, under new agreement which will replace gas-injection program with water flooding. . . . Texaco to be operator of unit. . . . ¶Northeast Elmore Third Deese Sand unit now in operation in Garvin County, Oklahoma, with Carter Oil Co. as operator. . . . ¶Three hundred operators visit water-flood operations in Greenwood County, Kansas. . . .

ACTIVITY—Crude production averaged 6,250,515 bbl. daily for week ended October 13, down 11,420 bbl. daily. . . . ¶Total well completions decreased 8 wells to 880. . . . ¶Wildcat completions totaled 208 compared with 168 for same week last year. . . . ¶Rotary rigs operating in United States on October 8 increased 39 rigs to set a new record at 2,828. . . .

TRENDS—Stocks of four major products on October 6 were 39,887,000 bbl. greater than last year with 20,223,000 bbl. of the increase in District 2. . . . ¶Major product inventories gained 6,962,000 bbl. in 4-week period ended October 6 compared with 5,339,000 bbl. in same weeks last year. . . .

Inside Abadan

Worried Iranians hope to get units in partial operation, Journal international editor finds on visit to refinery

Dahl M. Duff

ABADAN, Iran.—Although the last of the British staff is gone, small parts of the vast organization which Anglo-Iranian Oil Co., Ltd., developed here over the last 40 years continue to run for the time being under their own momentum.

A tour of the refinery a few days after the departure of the remaining British personnel showed that the Iranians are carrying forward the services, administration, and some degree of refinery maintenance. The units themselves are, of course, shut down.

Right now, the Iranians are enjoying what will probably be the happiest period of their oil-nationalization effort. The problem of materials and foodstuffs is being met by the large stores left behind by the company. The Iranian work force, which was paid by the British up to their final eviction, continues on the job.

The question seems to be one of how long a period will elapse before disintegration will become evident. As far as the organization is concerned, difficulties will certainly come soon if the national oil company is unable to meet the payroll.

Big storage.—The Abadan storage contains a supply of products sufficient to meet Iran's internal needs for nearly 2 years. The tanks are being drawn down gradually, and officials of the national company think that enough will be taken off in 2 or 3 months to allow them to start the operation of at least one still.

Aside from the many shuttered and closed bungalows, the company area gives an outward appearance of normalcy. Iranian Army guards, most of whose equipment is American, are scattered throughout the area. The Iranian employes are still carrying on as far as possible as they did before the British left.

The only non-Iranians left in Abadan are a half dozen newspaper correspondents. They live at the company's comfortable Riverside Hotel where they were originally guests of Anglo-Iranian and are now continued in the same status by the national oil company. There have been so far no significant restrictions on their movements.

Iranians moving in.—Iranian families are gradually moving into the homes formerly occupied by the British staff. The evacuated British were able to take personal effects but not the home furnishings which were company owned. Officials of the Iranian national company say that some of the families are being moved into the former British houses on a temporary basis until Iran is able to obtain the foreign technicians it needs for the operation.

In the refinery itself, the only facilities operating are the power plant, the maintenance shops, and the canning plant. The only shipping of any size at the docks is a few small Iranian naval vessels.

Conscious of problems.—Some of the former Anglo-Iranian employes who have been suddenly catapulted into top management jobs at Abadan seem to be conscious of the immense problems they face in attempting to continue the operation. Besides inexperience in the positions they now hold, there is also the critical question of the flow of supplies, foodstuffs, spare parts, chemicals, etc., all of which in the past have been imported by the company from outside Iran.

The supply of chlorine for water treatment at Abadan is reported to be running low. Tires for passenger cars are expected to begin to run out in the near future, and automobile cylinder heads are short. Large supplies of grain and other foodstuffs destined for Abadan have been diverted by Anglo-Iranian, or the orders canceled.

High ability.—On the other hand, a fact sometimes lost sight of by westeners is that people in this part of the world often show an amazing ability to keep mechanical equipment

From the World's Trouble Spot . . .

CONDITIONS in the idle Abadan refinery, center of a controversy affecting the entire world of oil, are described in this on-the-spot article by Dahl M. Duff, the Journal's international editor. Duff is currently touring the Middle East and was invited into the Abadan plant by the Iranian Government. His is the only first-hand report by an oil writer to come out of Iran since that country attempted to nationalize the properties of Anglo-Iranian Oil Co.

Before going to Abadan Duff was in Basrah, Iraq., where he witnessed the evacuation of the last British personnel from Iran, which he described in these words:

"The airport here at Basrah is jammed with A.I.O.C. personnel.

"Those I talked to weren't especially sorry to leave Persia but they were bitterly resentful of the fact that they had been forced out.

"The departure was without incident. In fact, the Iranians, it appears, went out of their way to avoid any trouble. Customs was facilitated, and there were very few people in the bazaar to see them leave, the assumption being that the Iranian authorities kept their own civilians out of sight.

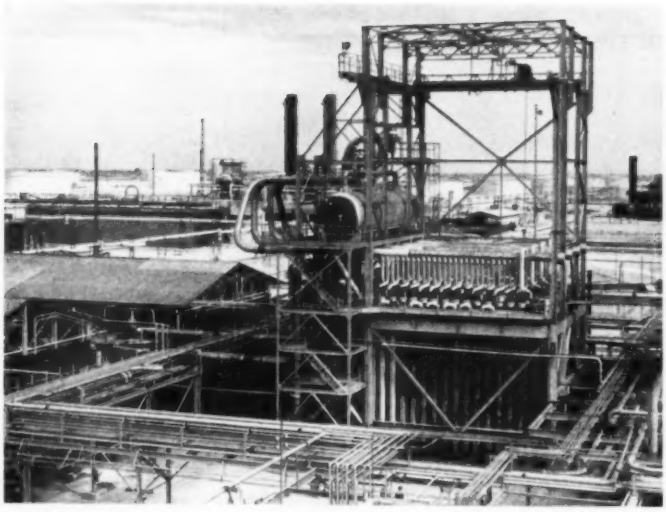
"Anglo-Iranian was able to get out five more of its tugs and bring them up the Shatt-el-Arab River to safety in Iraq.

"The evacuation of these staff people was altogether pretty tragic. Some of them had served in Iran 15 or 20 years or more, and regarded it as home. They left behind houses, furniture, associations, etc.

"From what I was told the refinery will go down hill pretty fast. The staff had been locked out on June 24, and nobody believes the Iranians are capable of performing necessary maintenance. Corrosion will be rapid, and the products now in storage are probably already off-specification and would require rerunning.

"One refinery supervisor said that 2 days before they were shut out an Iranian, who had been appointed to handle a certain section of the refinery, came to him completely baffled with the relatively simple problem of why a certain pump wouldn't run. That, he said, illustrates one reason why the whole operation will quickly go to pot.

"Many of the British seem to feel that their government should have taken a firmer stand long ago. They hope the United States will not give any help, financial or otherwise, to the Iranians. Of course, these were personal expressions of miscellaneous ones of those evacuated."



IDLE CAT CRACKER.—This is one of the catalytic cracking units at the Abadan refinery in Iran, which is now closed down. Iranians report they are carrying out an adequate maintenance program.

functioning one way or another. It may not be to European or American standards of efficiency but nevertheless it continues to run.

In the operation of the Abadan refinery, the size of the installation works to the advantage of the Iranians. There is practically no possibility that they could, unaided, start and keep in operation the entire plant, including catalytic cracking, aviation-gasoline and lubricating-oil manufacture. However, the present group could undoubtedly run one or more of the distillation units indefinitely by using the refinery shops and by cannibalization from the other idle units where necessary.

Drop in the bucket.—As long as export is prevented, the rate of throughput would be extremely low. Iranian officials say they have arranged to send some products to Afghanistan by tank truck overland, but this is only a drop in the bucket compared to Abadan's capacity. The British make the point that legally the property is theirs. The Iranians recently sought to deliver products down the Persian Gulf coast by using an Anglo-Iranian tug and barge. It was seized by the British and taken to Kuwait. The same treatment threatens any tankers lifting oil from Abadan. They probably would be escorted to a British-controlled port and required to unload their cargoes.

Acting works manager of the Abadan refinery for the national company is F. Ashraf, who worked for Anglo-Iranian 16 years, lastly as assistant chief chemist. He was educated at Wayne University, Detroit, and did post-graduate work in chemical engineering at University of Oklahoma in 1935.

Ashraf said the most essential maintenance and repairs are now being performed in the refinery. Inspection and repair work undertaken by the British after the refinery shut down at the end of July is being continued. He said there had as yet been no serious off-specification deterioration of the products in storage but that they were being constantly checked.

Urgent need.—One urgent need of the Iranians now in control of Abadan is to get the lubricating-oil units running. This new plant, built by an American engineering company (Badger) was almost ready to be commissioned when the refinery was shut down. It was intended to make unnecessary imports of lubricating oil into Iran. Since Anglo-Iranian's imports have stopped, lubes have become critically short for internal distribution within Iran.

The Iranian technicians report that two rotary filter drums in the M.E.K. plant have cracked, and that they need the services of the American specialists who built the equipment. They say the government's representatives in New York have approached the American company concerned but without success.

M. Bazargan, chairman of the temporary board of directors of the national Iranian company, discussing the possibility of resuming operations, emphasized that the Kermanshah refinery, an Anglo-Iranian topping plant north of Abadan which produced for local requirements in Northwest Iran, had never stopped running. He said 8 Iranians had been sent to replace the 25 British staff members at Kermanshah and that the plant was continuing an 800,000-ton-a-year throughput (16,000 bbl. daily).

He said the nations which will buy Iran's oil are waiting only for the political situation to clear. There have been, he said, offers from all parts of the world. Condition of the refinery equipment is "normal," he added.

Spare-parts problem.—Dr. Reza Fallah, chief technical adviser to the national company and also a former A.I.O.C. employe, conceded that the problem of spare parts for the British-made equipment would be difficult when operations were resumed. He said the shops can manufacture many items, that there are some spares on hand now, and that "certain arrangements" for spare parts would be made later.

He said the national company could get part of the refinery going again in from 1 to 2 weeks and mentioned 1,000,000 tons a year (20,000 bbl. daily) as a possible initial throughput rate, which would be permitted by the current withdrawals from storage for Iranian consumption. As for corrosion, he said the operating force is being kept busy overhauling various plants, now the special-products area.

When the Iranians took over, some crude-oil storage was available at Bandar Mashur, another Anglo-Iranian tanker-loading point south of Abadan. According to the Iranians, they have since pumped about 3,600,000 gal. (about 100,000 bbl.) out of Agha Jari field and into tankage at Bandar Mashur. This was done over a 12-day period. It is the only oil so far produced by the national company.

The production side of the new national Iranian operation is in charge of Sadeg Torabi, who studied at University of Oklahoma in 1937. Garnik Thomas, educated in England and formerly with A.I.O.C.'s maintenance organization, has been placed in charge of refinery maintenance.

Products stored.—The Iranian officials report that as of September 30, the following quantities of products were in storage at Abadan: avgas, 35,000 tons; 70-octane motor fuel, 444,000 tons; white spirits, 27,000 tons; kerosine, 98,000 tons; tractor fuel, 43,000 tons; gas oil, 174,000 tons; diesel oil, 135,000 tons; fuel oil, 772,000 tons; and crude oil, 182,000 tons; total 1,910,000 tons. They make a point of the fact that the pipe line to Ahwaz is still operating. This line leads to the railhead and is a link in the main supply system to the interior of Iran.

Most of the Iranians now in positions of authority at Abadan are full of complaints against the British. The lack of technical personnel to fully staff the refinery they blame on British failure to train them.

They are able to find all sorts of legal and moral justifications for their government's course. They have even indicated they believe some of the supplies Anglo-Iranian diverted to Basrah, Iraq (for example, lubri-

cating oils), actually should be sent on into Abadan for their use, despite the British eviction. One Iranian engineer said the Americans had "not finished their job" building the lubricating-oil plant and that such a plant was customarily turned over complete with some technical assistance in its initial operation.

Political view.—On the political side, there is some evidence that the oil issue is becoming a matter of national pride, although the obvious fact is that the average Iranian workman is not too interested in who controls the property as long as he has his pay and food. However, the importance which Iran has suddenly acquired among the world powers is certainly appealing to the national consciousness of many Iranians.

The 325 British staff members who were evacuated out of here told stories of corruption and inefficiency among the Iranians after their arrival in Basrah. They were convinced the Iranians can never operate the refinery as such or with any degree of efficiency. One British engineer reported, for example, that it had been a fairly frequent occurrence at the refinery to be offered a substantial sum of money to promote an Iranian to foreman, regardless of his qualifications. It had become impossible to discipline an Iranian caught stealing tools or equipment and the usual occurrence was for him to show up later on the payroll in some other department.

Meanwhile in New York Premier Mossadegh of Iran went before the U.N. Security Council and warned that the organization should keep "hands off" in the dispute. (See International.)

SOUTHWEST

Production Pressure Eased

Rising stocks, success in making up world deficit due to Iranian shutdown permit decline from peak oil output

HOUSTON.—Rising stocks of crude oil and increasing success in making up the world deficit in petroleum supplies caused by the Iranian shutdown have eased the pressure for high production in the Southwest and permit a decline from the peak output of the past 3 months.

This became evident last week when both Texas and Louisiana held hearings on November allowables and received reports from officials of the Petroleum Administration for Defense which were interpreted as being much less gloomy than earlier requests for maximum crude output.

Bruce K. Brown, deputy petroleum administrator, told the Texas Railroad Commission that the outlook for crude-oil stocks has improved since October 3, date of his last report to the commission. The Texas regulatory body has been particularly concerned over the stock situation, fearful that inventories would build up to an excessive level.

In his earlier report, also submitted to the Louisiana Conservation Commission, Brown estimated that the United States would be called on for only 280,000 bbl. per day to supply the loss of Iranian oil, compared with an earlier estimate of 460,000 bbl. daily *(The Oil and Gas Journal, October 11, 1951, page 75)*. The 280,000 is made up of 190,000 bbl. daily of refined products exported and 90,000 bbl. daily of crude originally intended to be imported into the United States but now being diverted to European refineries.

Margin of safety.—Despite this admittedly brighter picture, Brown, in other statements during the week, expressed the opinion that the industry should continue to produce at its maximum rate for another 60 to 90 days to provide a margin of safety. He pointed out that the winter period of peak consumption of petroleum products is just at hand and that a severe winter would cause a rapid drawback of stocks.

AUSTIN.—The Texas Railroad Commission this week set November allowables at 3,005,081 bbl. daily, which is a reduction of 98,184 bbl. daily below the allowables as of October 13. The cut was accomplished by keeping East Texas field on 19 producing days and cutting the rest of the state to 23 days.

This is the third consecutive month that Texas allowables have been set above 3,000,000 bbl. daily.

Following the Louisiana hearing last week, Conservation Commissioner S. L. Digby said that it is probable that the state's allowable for November and December will be reduced to the August level. Official announcement is scheduled for October 23. Louisiana's August allowable was 640,994 bbl. daily. At the request of PAD this was raised to 657,481 bbl. during September and 653,370 bbl. for October. The indicated cut would be about 16,000 bbl. daily.

Texas average.—The Texas allowable for October, a 31-day month, was set to average 3,115,512 bbl. per calendar day, based on 19 producing days in East Texas field and 25 days in the rest of the state.

Evidence at the Railroad Commission's hearing in Beaumont last week pointed to a November schedule of 19 days in East Texas and 23 days elsewhere, which would be a reduction of about 90,000 bbl., on the average, for each of the 30 days in the month.

Buyers' nominations submitted prior to the hearing totaled only 2,875 bbl. less than October nominations, but some nominations were revised downward at the hearing. Most large producers went to the hearing prepared to ask for a 24-day producing schedule outside of East Texas, but the majority of them agreed that 23 producing days would be adequate.

PAD statement.—The statement Bruce Brown filed with the Texas commission made no specific recommendations as to Texas production, but gave this summary of PAD's estimate of the future:

"Assuming refinery runs of 6,750,060 bbl. per day were achieved, as were included in our previous analysis, crude-oil stocks at the end of 1951 would be 5,000,000 bbl. more than we believed to be adequate.

"This is approximately 85,000 bbl. per day during the months of November and December. The resumption of production from Iran and the distribution of products from the Abadan refinery is unlikely during the first quarter of 1952.

"This is the period of peak consumption in the United States. Although we approach this period with adequate stocks of crude oil and products, it is possible that we may require from this country more than we have anticipated to meet our own demands and those formerly supplied from Iranian crude oil and the Abadan refinery.

"It may be necessary, therefore, depending upon the circumstances we encounter within the near future, to supply as much crude oil as we are now producing in the United States during the coming winter."

"Abnormal" increase.—Following the hearing Chairman Olin Culberson pointed to what he termed an abnormal increase in crude stocks to a total of 255,000,000 bbl., and said he was concerned about saving some reserve producing capacity in Texas against a day when the need for more oil might be more pressing.

The Texas commission did not take up the matter of gas flaring in West Texas, although it had asked for reports to be submitted at the Beaumont hearing. This was interpreted to indicate that a reduction to 23 producing days in that area would eliminate much of the excess gas production.

Spraberry Wrangle

Plans for change in spacing rules dropped when several operators, royalty and landowners voice strong protests

Roy F. Carlson

MIDLAND, Tex.—Opposition of several operators and royalty and landowners in the vast West Texas Spraberry trend at a special meeting here caused any suggestion or recommendations of changes in spacing rules to be dropped. According to these operators, development should be carried on according to present patterns and rules.

The meeting, second of two held by operators, was convened to consider suggested recommendations made by a committee of operators' representatives that would widen spacing to some extent, and spread available supplies of steel over a larger part of the Spraberry area. Generally the suggested plan would allow either 40 or 80-acre spacing of wells with allowable production being based on the basis of 50 per cent acreage and 50 per cent well on an 80-acre proration unit.

Wells already drilled on a 40-acre pattern, and wells offsetting those would be given an 80-acre allowable. The suggested plan would affect only the area south of the south line of Township 3 South in Midland and Glasscock counties. *(For the complete text of the suggested rule see The Oil and Gas Journal, October 11, 1951, page 85).*

Sharp contrast.—The Midland meeting was in marked contrast to the first meeting held in Fort Worth. At the first meeting, operators were pretty much in accord that shortages in supply of oil-country tubular goods and suggestions that the Petroleum Administration for Defense might require some sort of wider spacing than is currently employed created a problem that should and could be solved by voluntary agreement of operators in the field. At this second meeting objections, primarily from independent operators and landowners, were raised to the spacing plan that was offered, and to the idea that any recommendation of any sort should be made to the Texas Railroad Commission.

Spearheads opposition.—Jack Blalock, Houston attorney representing operators and royalty owners of some 50,000 acres of the trend, spearheaded the opposition to any suggestion of wider spacing. He suggested that he didn't believe Railroad Commission has authority as a conservation body to divide an area that has been indicated to be a common reservoir as in the case of the Spraberry into two different spacing patterns on the basis of what he called an entirely economic question. He said the question of spacing had already been decided by the Railroad Commission at a previous proposal for 80-acre spacing that had been denied by that body.

Some of those present doubted that PAD had authority to single out one field, as it has suggested with regard to the Spraberry, and promulgate some kind of spacing rule for that area. But Arch Rowan, Fort Worth independent operator who called both meetings, told those assembled that PAD thought it has that authority under the National Emergency Act, and that it would probably do something toward reducing the amount of steel that was being used in the Spraberry development.

Saving questioned.—A part of the operators questioned whether the suggestions put together by the operator's committee would actually save steel, and whether it would be recognized by PAD. Some questioned whether it would help them to get pipe ultimately.

Others of the operators argued that PAD's allocation program of one string of pipe per 800 acres per quarter of the year would solve the problem of steel conservation. These men also observed that some of the operators were currently carrying out development programs on the basis of 80-acre spacing. These apparently are on large tracts where offset obligations do not require closer drilling.

Real pinch.—The offset requirements are apparently causing a real pinch when the operator required to drill does not have the tubular goods for the wells. These operators are apparently unable to get the steel they need to drill the wells, but at the same time must drill them or jeopardize their leases. In this regard, Rowan said that Texas has a ratable take law that protects producers and he added that some observers feel that there might be a provision for "ratable drilling" that would protect those unable to obtain pipe now.

Land and royalty owners at the meeting suggested that they were interested in getting wells drilled on any spacing. Some of these men, they said, own land that is surrounded by drilled or drilling wells, when not one well has been drilled on their property.

WEST COAST

Imperial Valley Play

Texas Co. will soon start first of several exploratory wells in little drilled, generally condemned region

D. H. Stormont

LOS ANGELES.—The Texas Co. shortly will start the first of several planned exploratory wells in little drilled and generally condemned Imperial Valley, climaxing about 2 years of geological and seismic work and the assembling of several large blocks of acreage extending northward from the Mexican border into Riverside County.

In this 100-mile stretch, about two dozen wildcats have been drilled to date, with most of the activity concentrated around the southern end of the Salton Sea. Only three of the tests have been carried below 7,000 ft.

None is believed to have encountered any oil shows so that the valley is generally classed as unfavorable. But so was Cuyama Valley, which currently is producing about 61,000 bbl. daily, until Richfield Oil Corp. discovered oil there in 1948.

Texaco's first well will be located 5 miles west of Calexico, about 1 mile north of the Mexican border, and will be labeled No. 1 Jacobs NCT-1. Drilling is expected to get under way before the end of the month, and it is thought hole will be carried to around 7,500 ft. Contract has been let to San Joaquin Drilling Co.

Leasing complicated.—Leasing in the valley is complicated by the fact that most of the area is government owned, including much Indian reservation lands. In order to acquire the acreage it desired, Texaco was required to negotiate several unit plans with the Government. It is now in the process of unitizing government leases acquired by individuals, and as these blocks are completed they will be drilled. Thus in the next few months it is expected that some five or six new wildcats will be staked.

Little drilling since 1948.—Little drilling has been done in the valley since 1948. In that year Amerada Petroleum Corp. abandoned a 7,323-ft. test north of Calexico and a second 8,350-ft. wildcat near Brawley. About 14 miles northeast of Calexico, Texaco the same year abandoned its No. 1 Grupe-Engebretsen after drilling to 12,313 ft.

Steel Allocations Set

NPA earmarks 1,708,500 tons for oil, gas operations during first quarter of 1952, a cut of 98,000 tons

Bertram F. Linz

WASHINGTON. — Steel allocations for petroleum and natural-gas operations during the first quarter of 1952 have been set by the National Production Authority at 1,708,500 tons, a cut of 98,000 tons from the 1,806,500 tons allowed for the current quarter.

Petroleum Administration officials are appealing DPA's decision, seeking to get an allocation nearer the 2,085,000 tons which they contend represents the actual needs of the industry if it is to carry out the programs set up for this year.

While the industry was placed on a starvation diet of steel, it will be given slightly more copper and aluminum for the first 3 months of 1952 than it received for the present quarter—8,300,000 lb. of copper and copper-base alloys against 7,975,000 lb., and 850,000 lb. of aluminum against 785,000 lb.

The cut in the steel allocation is viewed by PAD officials as distressingly great and so far below the 2,085,000 tons requested that the utmost economy will be required to spread it across the industry.

So far as oil-country tubular goods is concerned, about the same amount of steel will be earmarked as at present. The current allotment for production activities is 465,000 tons, which does not include conversion steel, and the first quarter allotment will be 495,000 tons, including conversions.

Out of this 495,000 tons, however, it will be necessary to take 10,000 tons for Canadian operations and 45,000 tons for operations of American companies abroad, leaving available for domestic operators 440,000 tons.

Gas lines hit.—Announcing the allocation for the petroleum and gas industry, Defense Production Administrator Manly Fleischmann said it is "intended to maintain the petroleum production and refining program at a high level." But some of the proposed construction of gas transmission lines will have to be deferred, he added.

PAD, however, does not agree that operations can be continued at a high level with the amount of steel announced and foresees the possibility that many important operations will have to be slowed down or deferred unless more steel is made available. In view of the cut and the prospect that steel supplies will not be materially improved in the second quarter of next year, no plans can be made to increase the drilling rate to the 50,000 wells a year which Interior Secretary Oscar L. Chapman said earlier this month should be the 1952 objective.

Toughest period.—Defense Mobilization Chief Charles E. Wilson and Fleischmann both emphasized that the first half of 1952, and particularly the initial 3 months, will be the toughest period in the defense program, so far as the major metals are concerned.

Compared with the current quarter, direct military demand in the first quarter of next year will call for 408,000 tons more steel, 81,000,000 lb. more copper and 80,000,000 lb. more aluminum, and there is nothing in the picture to indicate that requirements will be any less in the second quarter.

Since these increases for the military are substantially more than any possible increase in supply, these changes in themselves have imposed a squeeze on everything else, Fleischmann said.

All told, the first-quarter allocations cover 23,214,000 tons of steel, or about 112 per cent of the estimated supply; 1,367,000,000 lb. of copper and 713,566,000 lb. of aluminum, each about 110 per cent of the expected supply. The excess of allotments over supply, however, is expected to be dissipated by "attrition," officials explaining that actually all of the Controlled Materials Plan allotments authorized in any quarter are not used, due largely to changes in specifications and designs, and adjustments in military programs and contracts.

Metals requests.—To get supply and demand into any sort of balance, DPA had to cut the requests of claimant agencies sharply. Requests for steel, it was said, amounted to 32,954,000 tons, or about 165 per cent of the estimated supply of 21,125,000 tons. Requests for copper totaled 2,083,000,000 lb., or 161 per cent of supply, and claims for aluminum were 974,000,000 lb., or about 150 per cent of an estimated supply of 646,000,000 lb. which can be realized, DPA said, only if the aluminum plants can continue to operate at full production levels.

The steel allocation for railroad equipment is designed to provide material for the production of 2,000 tank cars.

The limited allocation will bear most heavily on foreign operators, who may be forced to slow down development work in Venezuela and Saudi Arabia since they expect to be on practically a no-inventory basis within a few months.

Approximately 118,000 tons of steel was asked by the companies for their operations abroad. This was cut by PAD to 95,000 tons with a requirement that 30,000 tons be secured from foreign sources, which would have left an allotment of 65,000 tons.

DPA officials, however, felt they were unable to go along with that figure.

Exemption sought. — Meanwhile, Petroleum Administration officials have secured an exemption for oil-country tubular goods from the provisions of a Controlled Materials Plan regulation requiring that unfilled orders for steel, copper, and aluminum products not shipped by mills by October 7 must be charged to fourth-quarter allotments.

The application of that requirement could in effect be a reduction in fourth-quarter allotments and an impediment to PAD's development program.

The purpose of the NPA order was to put the CMP on a flat quarterly basis, to do which it was felt necessary to clear mill books of third-quarter orders. The PAD program, however, is based on a policy of continuous development which would be set back by the order.

Two directives. — The exception for oil-country tubular goods was provided for through two new directives applying respectively to domestic and Canadian operations and foreign operations.

Both directives provide that an operator may accept delivery of pipe whenever he can get it without adjusting his outstanding controlled orders. PAD is distributing oil-country goods through 3,850 operators, 3,700 of whom drill 40 or fewer wells a year, and it is the latter group that has the greatest difficulty in getting controlled material. At the same time the steel mills making tubular goods are not able to adjust their production exactly to calendar quarters.

New Diesel-Fuel Addative

WASHINGTON.—A new chemical compound designed to raise the quality of diesel fuel to Navy requirements without the refining now necessary is being tested by the Navy's Bureau of Ships.

Developed by the Ethyl Corp. during 4 years of research, the compound is a blend of several amyl nitrates found to be the most economical and practical as a quality booster of diesel fuel.

If successful, the Navy Department said in announcing the tests, the compound will greatly increase the amount of fuel oil available for sub-

marines and other diesel vessels without added strain on the refining industry.

Rear Adm. H. N. Wallin, chief of the Bureau of Ships, also foresees the possibility that diesel manufacturers will be able to design engines to operate on a uniform grade of fuel from coast to coast, instead of on the broad range of fuels now being produced, and thus insure better engine performance. This might be possible, he said, because the new compound, when added in different amounts to fuels of different grades, could raise them all to a uniform level.

Wallin said no plans for making the amyl nitrate blend available commercially have been announced by Ethyl Corp., and no such plans are expected to be made until after the Navy tests are completed. Production now is being limited to those quantities required for test purposes.

Tanker Probe

Senators dig into 1949 deal in surplus vessels

WASHINGTON. — A 1949 surplus-tanker deal, which reportedly returned a $2,800,000 profit on a $100,000 investment, has become the subject of exhaustive investigation by the Senate investigations subcommittee.

Committee staff experts are digging into the income-tax returns of the participants, including former Massachusetts Congressman Joseph E. Casey, the late Secretary of State Edward R. Stettinius, and Adm. William F. Halsey. Casey already has told one Senate committee how he and his associates divided the profit on the deal and paid a 25 per cent capital-gains tax instead of the much higher income-tax rates.

Truman approval.—Sen. Clyde R. Hoey of North Carolina, chairman of the subcommittee, said President Truman had authorized his group to examine the tax returns of all concerned in the transaction, but added that the preliminary investigation will be a big job and public hearings probably will not be held until next year.

The tanker deal was investigated last spring by the Senate banking subcommittee headed by Sen. William Fulbright of Arkansas, but the matter was turned over to Hoey's subcommittee after Casey challenged Fulbright's jurisdiction.

The ship transaction bobbed up last February during hearings on the activities of the Reconstruction Finance Corp., when Casey was called as a witness during the probe of "favoritism and influence" exerted to obtain RFC loans.

The following month the Fulbright subcommittee attempted to go into the deal in detail and was given much information before Casey refused to

WATCHING WASHINGTON

Bertram F. Linz

Prediction on Imports

It's never safe to make predictions about the Truman administration, but there are some factors in the international oil situation which, with the known proclivity of the present Government to go all out on the good-neighbor policy, could be interpreted as meaning that the import quota on oil will be eliminated and the import tax further reduced in the new reciprocal trade agreement with Venezuela.

Factors which may carry weight with government men not unduly sympathetic to the oil industry and who will have a hand in negotiation of the agreement are the shutdown in Iran (regardless of the fact that gap is now rapidly being filled) and the years'-old theory of using foreign oil to save our own.

An important factor, however, is the pressure of Venezuela for elimination of the quota which is costing the government partner in the Venezuelan oil concessions several million dollars a year. There has been a tacit warning that if Venezuelan oil cannot come into this market on favorable terms Venezuela won't have the money to buy American products and, further, might have to seek new markets, in which event the oil may not be available to us should an emergency develop.

Canada also is viewed as having a stake in the treaty. Now subject to quota provisions but without a specific allocation, interests looking ahead to the development of Canadian fields and the day when that oil will be exported to the United States in quantity, would like to be assured there will be no impediment to its importation.

Playing Into Russia's Hands

Failure of the United States Security Council to settle the controversy over Iranian oil may result in Iran experiencing an economic crisis before the end of the year which might throw that country into the lap of the Soviets, according to men recently returned from the Middle East. The situation also could be reflected in Egypt, Jordan, and Syria in an effort to eliminate what is regarded there as "colonial exploitation."

The Iranian Government has taken the unrealistic position that it must get completely rid of the only agency that can make the country prosperous, and get the entire oil revenue for itself. Premier Mossedegh has the support of 95 per cent of the people and can't be pushed out, according to the experts, and the situation has reached the point where it is easier to find a foreign scapegoat than to tackle problems that should be solved.

With the rest of the world steadily making up the gap created by the interruption of Iranian production the problem is becoming less one of oil than politics. The controversy is playing into Russian hands and through Iran the Communists could get into the Persian Gulf area. No direct attack on Iran by Russia is foreseen, particularly as internal conditions are such that the country could readily topple over into the Red orbit.

Scrap Holds the Key

Scrap requirements of the nation's steel industry next year will be close to 40,000,000 tons to insure the projected production of 117,500,000 tons of steel.

The scrap-supply situation is the biggest question mark in the whole steel-production program. Without steel the oil industry's program cannot be achieved, and the whole defense effort will slow down.

A nation-wide drive to collect scrap has been instituted by the National Production Authority, but so serious is the situation that the General Services Administration has been authorized to buy $7,000,000 worth abroad, the Defense Production Administration is seeking battlefield scrap from Korea, and reclaiming sunken ships in the Marianas Islands, and the Defense Department has been asked to stop all sales of offshore scrap to foreign countries.

Meanwhile, the steel problem continues to broaden out. All steel, copper, and aluminum went under the Controlled Materials Plan this month, but the system doesn't appear to be working too smoothly. One big plate consumer, for instance, has been unable to book 35 per cent of its CMP tickets for the fourth quarter although assured by both NPA and the Petroleum Administration that mill space would open up as a result of cancellations forced by cutback allotments. So far, there is no sign of significant tonnage having been cancelled, and important oil-industry supplies are being held up.

discuss it further on grounds that the subcommittee's authority was limited to investigation of the RFC and it had no right to dig into his dealings with the Maritime Commission.

Formed firm.—In the course of his testimony, however, Casey said that with a number of other persons he joined in a firm called American Overseas Tanker Corp., which arranged to charter five tankers to Standard Oil Co. (N. J.), borrowed $10,000,000 from an insurance company on the strength of the charter, and then purchased five surplus tankers from the Maritime Commission.

Casey testified that the group incorporated a Panamanian subsidiary, Greenwich Marine Corp., to which title to the vessels was transferred and which collected the charter fees free of United States income tax and from them paid off most of the insurance loan. The capital investment of the group was $100,000, and the ships finally were sold at a profit of $2,800,000, he said.

No illegality.—Casey contended there was nothing illegal or unethical in the transaction, pointing out that the tankers were sold at prices set by Congress, that a year after their purchase they could have been bought on the open market for about 60 per cent of the prices paid the Government, and that due to inflation and world events the value of all tankers substantially increased in 1950.

The Senate commerce committee also looked into the matter, although it did not go into detail, and Chairman Edwin C. Johnson of Colorado asked Secretary of Commerce Charles Sawyer for a report on the department's role in the transaction.

Defense Orders

Various agencies issue controls on materials

WASHINGTON.—The following orders have been issued by defense agencies:

PAD:

Regulation 1, September 28: Authorizing the issuance of directives with respect to the delivery, receipt, or use of oil, gas or other products.

OPS:

Supplementary Reg. 2 to CPR 32, October 3: Providing a procedure for the adjustment of crude-oil ceiling prices out of line with prices in a general producing area.

NPA.

Amendment to Dir. 4 to CMP Reg. 1, September 28: Permitting the use of imported steel for the manufacture of more products than provided for on authorized production schedules.

M-47B, September 28: Replaces M-47A to permit flexibility in the use of steel, copper, and aluminum by manufacturers in certain classes.

Revocation of M-12, October 1: Repealing limitations on the use of copper, now regulated by the Controlled Materials Plan.

Revocation of M-3, M-10, M-14, M-30, M-33, M-49 and M-52, October 1: Repealing limitations on the distribution and use of columbium and tantalum-bearing steels, cobalt, nickel, tungsten, molybdenum, columbium and tantalum, and molybdenum-bearing steels.

Amendment to CMP Reg. 1, Dir. 7 to CMP Reg. 1, Dir. 3 to CMP Reg. 6 and Dir. 3 to M-5, October 1: Providing that unfilled orders for steel, copper and aluminum not shipped by October 7 must be charged to fourth-quarter CMP allotments.

Amendment to M-70, October 1: Extending priority assistance for MRO for marine maintenance through the fourth quarter.

Supplements to Delegations 1 and 2, October 3: Authorizing the Secretary of Defense and Atomic Energy Commission to apply the emergency symbol DX to orders where delay in delivery would jeopardize vital programs.

M-6A, October 5: Replaces M-6 and directs steel producers to begin shipment January 1 of tubular goods and other supplies to warehouses at a minimum of 100 per cent of average monthly deliveries through the first 9 months of 1950.

M-86, October 5: Regulating the distribution of copper wire mill products to distributors.

Direction 3 to NPA Reg. 2, September 25: Limiting authority to use defense ratings to acquire chemicals to the Department of Defense and the Atomic Energy Commission.

Amendment to Delegation 14, September 25: Clarifying authority granted secretaries of the Interior and the Army in carrying out approved construction programs.

Dir. 2 to CMP Regs. 5 and 6 amended, October 8: Extending the time during which owners of buildings damaged in the Midwest floods last July may continue to get special priority assistance for materials for reconstruction.

Amendment to NPA Reg. 5, October 10: Authorizing enlargement of the NPA appeals board to expedite the handling of cases.

Dir. 1 to M-11 revoked, October 10: Procedure for distributors to obtain brass-mill and wire-mill products from manufacturers transferred to M-82 and M-86.

Amendment to M-47A, October 11: Continuing the prohibition against the use of copper or aluminum for decoration or ornament of consumer durable goods.

Tidelands Stymie

No congressional action anticipated this year

WASHINGTON.—Chances of enactment of any sort of tidelands legislation this year are practically nil.

Although the date for the adjournment of Congress has repeatedly been set back, the chances now are good that the end of the session will come by the end of the month. Members of both houses, anxious to get home, are becoming restive under the prolongation of the session, and absenteeism is increasing—a definite warning to the leadership that it can't inject anything of less than vital importance into the legislative schedule.

Little progress appears to have been made by the Senate interior affairs committee toward reaching an agreement on the form of legislation to be sent to the floor. With the committee split three ways there is slim chance of getting a majority vote on any one of the three proposals before it. These are the O'Mahoney plan for interim federal management of the offshore oil fields, the Long proposal for interim state management, and a compromise providing for a division of authority.

Two bills may go.—If the deadlock cannot be broken, it is possible that Sen. Joseph C. O'Mahoney of Wyoming, chairman of the committee, may send two measures to the Senate without recommendation. One is his interim-management resolution and other a bill sponsored by a score of senators providing for restoration to the states of their title to the tidelands out to the 3-mile limit and full government ownership beyond the state line. It would then be up to the Senate to decide how to deal with the issue.

As it stands now, the House has passed the Walter quitclaim bill, but that measure cannot now get favorable action from the Senate committee. Any other legislation the Senate might pass would have to go to a conference committee. While some form of quitclaim might quickly be approved by such a committee, any other legislation would probably run into a long fight.

With practically no chance of getting final action before the end of the session, the committee may drop the matter until next year. Since there will be at best a recess of only 2 months between sessions, Senate leaders do not believe much damage would result from the laying over of controversial legislation not on the "must" program. This includes the tidelands measure.

Leveling Off Seen

Natural-gas-industry leaders see new activity slack-off following completion of vast postwar expansion program

C. O. Willson

ST. LOUIS. — Some leveling off in new activity, at least for a brief period, is in prospect for the natural-gas industry following a postwar expansion period which in magnitude has dwarfed any comparable span of the past.

This probable trend in a business which has spent more than five billion dollars in 6 years enlarging its nation-wide facilities was apparent from prepared statements and informal discussions of the leaders of the gas industry which met here October 15-17 in the thirty-third annual convention of the American Gas Association.

It was emphasized that this slowing up in growth does not mean the cancellation of any important phases of the present construction program, a large part of which is tied in with the defense effort. It is expected that 1952 expenditures next year will be nearly as great as the record-breaking figure for the year now drawing to a close totaling approximately one and one-half billion dollars.

Must coordinate.—But barring developments which cannot be determined now it is the feeling here that the gas industry as a unit and particularly the natural-gas division has reached the point where it will have to take time to coordinate what it has done in recent years and determine just where it stands as to future growth. Partially this is a reflection of conditions brought about by the defense planning and uncertainty as to what will happen after the present program is completed next year. Furthermore there is a general feeling that additional available gas reserves are necessary before the construction of large new systems or the extension of present systems are justified.

This attitude excludes the lines already approved by the Federal Power Commission, most of which have received priority ratings. This situation is further aggravated by the fact that some of the states with the largest reserves do not look with favor to additional interstate movements to distant markets. This position, it is assumed, would change if more reserves, largely in excess of long-time intrastate needs, were discovered.

Financial factor.—There is the additional angle that new financing for gas expansion which has totaled more than seven billion dollars since the close of the war may not be generally available until adjustments in wholesale and retail rates are made. It is pointed out that higher prices for natural gas at the wells, increased taxes and wages, and generally higher costs for materials and equipment, have not been offset in revenue in any instances. The higher rates are being sought but approval will be slow. In the meanwhile natural-gas expansion has lost some of its former attraction from the financial viewpoint.

No pessimism.—The foregoing report is not to be interpreted as indicating that pessimism prevails at this largest annual meeting of the gas industry which is being attended by approximately 4,000 registrants from all parts of the United States and Canada with representatives from other countries. On the contrary there was general agreement with the opening statement of D. A. Hulcy, the retiring president of the association, who said, "Our industry is thoroughly healthy and forward moving." Speaking on the subject "All Bargains Are Not Cheap," the head of the association and the president of Lone Star Gas Co., Dallas, made a strong appeal for the preservation of a free industry and the American way of life. He received a standing ovation at the conclusion of this address.

"I have heard good men, men with everything at stake, say in a weary tone of voice that we are headed straight for socialism in this country and that there isn't a thing we can do to stop it," Hulcy, who is also currently president of the United States Chamber of Commerce, said. "I wonder if these men realize fully what they are saying. If what these men say is true, then, in heaven's name why are we straining every nerve and skirting every edge of national bankruptcy to prepare an adequate defense against the communist power. If our free institutions are to be destroyed anyhow, if we are doomed inevitably to the slavery of socialism, why not resign ourselves to this fate and take things easy in the meantime."

GEORGE F. MITCHELL
New A.G.A. President

Answers own questions.—The A.G.A. head then proceeded to answer his own questions with an outline of what this country's industrial freedoms have meant, including the establishment of the world's highest standard of living. He presented current data on gas operations to show how free enterprise has met the nation's greater fuel needs. More than one million gas customers have been added over the past year and the total is now nearly 25 million in this country. Revenues have increased 15.4 per cent during the past year and on a yearly basis are now in excess of two billion dollars. Present reserves of 185 trillion cubic feet have doubled over the past 10 years and last year when seven billion cubic feet were produced more than five billion cubic feet were added to reserves.

Hulcy stressed that all this growth in production and expansion in transmission facilities had taken place with practically no increases in prices from prewar days while food prices have increased nearly 100 per cent in the same period.

PAD administration. — The natural-gas industry has not been mistreated by the Petroleum Administration for Defense but on the contrary, because of the essential part that gas is playing in the defense program, it has been favored, C. Pratt Rather, assistant deputy administrator of PAD, told a general session of the convention. The head of the Government's defense program so far as it applies to the production, transmission, and distribution of gas, at the same time emphasized that the industry should not expect continued special treatment when present major construction programs are completed.

In reviewing the principal developments of the 6 months with PAD Rather explained that all of the big-inch lines authorized by the Federal Power Commission have been given priority ratings so that they can be completed before the 1952-53 winter season. All of the large transmission lines under way this year should be completed soon with the exception of

two lines which supply gas to the Appalachian area. Approval of these large lines, Rather explained, was in recognition of the needs of defense enterprises.

Rather said that while support of defense industry was the major responsibility of the government administration PAD realized that due consideration must be given to the part that gas plays in maintaining the essential civilian economy. He explained this included the protection of those who are presently dependent on gas service.

The future.—In regard to the future the deputy administrator presented national figures showing the wide disparity between total supply and demand for steel and some other metals used by the gas industry. His talk indicated that there would be little steel available for new projects except as they tied in indirectly with the operation of defense and atomic plants.

Regarding the early part of next year he said, "I am sorry but I can't be optimistic over the outlook for more steel for the industry. I think we will be very lucky to continue to have as much as we have had the third and fourth quarters of 1951."

Defends order.—Rather defended the gas limitation order which became effective August 22 and which has been strongly criticized within and outside the gas industry. He described it as an essential order which brought about a slowdown but was not in any sense a freeze. He urged the cooperation of operators and state regulatory bodies in assuring the adequate and proper distribution of gas to the consumers with the federal agencies limiting their activities to the interstate distribution of gas.

He expressed the hope that when the present defense act expires next April that it will no longer be needed including the agencies and controls now in effect. He closed with a plea that companies continue to make key men available to staff the present PAD organization.

Big expansion.—Other statistical information presented here revealed that the natural gas division of the gas industry is enjoying the greatest expansion in its history. For the year ending June 30, 1951, total sales increased 16.6 per cent over the previous year with a 19.4 per cent gain in revenue. The largest percentage volume gain was in residential sales with an increase of 19.4 per cent. Commercial sales were up 9.7 per cent and industrial sales 16.6 per cent.

Discussions reflected the wide interest in the growth of underground storage over the past 3 years with several projects to be used the first time this winter. It was pointed out that further growth in this type of storage will make it possible to service more residential consumers, the most profitable phase of natural-gas distribution. At present, in order to take care of the winter peaks in residential consumption, dumps to industry during the summer at low and often unprofitable prices are necessary.

Committees meet.—A large part of the 3-day annual meeting was devoted to committee discussions and group meetings where special subjects were discussed. These sessions reflect the present ramifications of the gas industry directed by the association which now has an annual budget of $3,700,000. The committee meetings and group sessions discussed a variety of subjects, including taxes, auditing procedures, industrial relations, federal housing, the association's large research program, testing methods, processing, and byproduct operations. The association devotes considerable time to merchandising problems and a national advertising program of $800,000 is part of the annual budget.

Officers.—George F. Mitchell, president of Peoples Gas Light & Coke Co., Chicago, was elected president of the association and will serve until October 1952.

Mitchell, a pioneer in the expansion of the artificial-gas business, in recent years has been prominently identified with the introduction of natural gas in the Chicago area including the acquisition and building of important transmission lines connecting to supplies in the Southwest. He is a director of two of these systems owned by Natural Gas Pipeline Co. of America and Texas Illinois Natural Gas Pipe Line Co.

Mitchell is also a director of Natural Gas Storage Co. of America. He is credited with having a prominent part in making natural gas available to the Peoples company in 1930 through a contract with Natural Gas Pipeline Co. of America which built the first large transmission line from Texas to the Chicago area. He became president of the Peoples company in 1930.

Other officers of the association for the coming year include: Charles E. Bennett, president, Manufacturers Light & Heat Co., Pittsburgh, first vice president; E. H. Eacker, president, Boston Consolidated Gas Co., Boston, second vice president; and Edward F. Barrett, president, Long Island Lighting Co., Mineola, N. Y., treasurer.

Chemicals Supply

Oil-company participation aids chemical industry in output of vital products but material shortages prevail

George Weber

WASHINGTON.—Due in part to participation by oil companies, the chemical industry faces no foreseeable production emergencies which might be considered as critical. Like the petroleum industry, chemicals are hampered in obtaining the materials which private capital is willing to purchase for a vast expansion of all producing facilities, but raw materials for petroleum-derived chemicals are in most cases plentiful and pose no barrier to extended operations.

Three chemicals of interest to oil operators, benzene, sulfur, and ammonia, came up for particular discussion last week at a meeting sponsored by National Production Authority's Chemical Division for editors in chemical and associated fields.

Benzene supply.—Louis A. Schlueter, chief of the Coal Tar Chemicals, Dyes, and Intermediates Branch of the Chemical Division, indicated a rapidly growing demand for petroleum benzene regardless of future military requirements. Domestic benzene requirements this year will probably top 260,000,000 gal., he said. The indicated demand by 1955 is on the order of 411,000,000 gal., more than double the 1950 consumption.

For this rising usage, coke ovens will not be able to supply much more than the current 175,000,000 to 180,000,000-gal. annual rate. The balance must come from petroleum and European imports. Petroleum benzene, said Schlueter, will amount to 25,000,000 gal. in 1951. Capacity by the end of this year will have risen to 40,000,000 gal. By mid-1952 petroleum-benzene production should reach the 60,000,000-gal. rate and hit 90,000,000 gal. by the end of next year.

Aromatics program.—That is not the end of the expansion program, however. Petroleum Administration for Defense officials state that facilities now recommended for necessity certificates will bring the total capacity to about 130,000,000 gal. per year before 1954 if all facilities so authorized are installed. The aromatics program sparked by PAD will also provide capacity for 130,000,000 gal. of toluene and over 260,000,000 gal. per year of aromatics blends suitable for upgrading aviation gasoline.

Schlueter singled out PAD for particular credit for the cooperation which that agency, representing the oil industry, had given the benzene program. Imports, now providing about 20-25 per cent of domestic requirements for benzene, have been most helpful in keeping benzene-consuming industries in step with the military-preparedness program. How-

ever, projected dependence on imports can prove precarious in a hotter emergency and the gap between demand and domestic production should be closed if possible, with increased production from petroleum and to whatever extent possible, from coke-oven sources.

Sulfur.—Sulfuric acid, the index to American industrial activity, is and will continue to be in short supply for some time to come. We are currently producing 12,000,000 tons per year of fresh sulfuric acid. The primary means for stretching this supply, said Frederic Arden, chief of the Inorganic and Agricultural Chemicals Branch, lies in reduction of waste through better recovery practices. These embody more efficient regeneration of spent acid sludge and recovery of sulfur and sulfur compounds in waste products.

New discoveries of native crude sulfur notwithstanding, this nation cannot continue to meet expanding sulfuric acid requirements from this low-priced source alone. We must continue to program new facilities for sulfur recovery from sour gas, smelter gas, and pyrites, said Arden. Unlike benzene on which we received some aid from European producers, sulfur is in strong demand abroad. Arden expressed the opinion that European countries should develop their own sources from pyrites.

Again in the sulfur picture, the petroleum industry is in the forefront of expansion activity. PAD recently revealed that the industry will produce a surplus of sulfur through its own operations. A major consumer of sulfuric acid, the industry will use an estimated 638,000 long tons of equivalent sulfur this year. But, by means of acid-recovery programs, sulfur extraction, and captive usage and by production of hydrogen sulfide converted to acid by outside companies, the oil industry will have produced an estimated 643,500 long tons of sulfur this year, 5,500 tons over consumption.

PAD has approved a number of applications for necessity certificates on sulfur recovery projects, some of which are under construction by oil companies. Of the total number of applications submitted, nine new projects, to cost $5,423,000, have been approved to date by NPA. A survey of the potential recovery of sulfur from refineries and natural-gasoline plants indicates that this is a small part of the industry's capabilities in this respect.

Ammonia.—Expansion of the synthetic anhydrous ammonia industry is similarly keyed to petroleum. Arden contrasted 1930 production of 161,700 tons of chemical nitrogen with the projected capacity for 2,256,000 tons for 1953. Present capacity totals 1,624,000 tons per year of synthetic nitrogen in various forms. Construction covered by accelerated amortization certificates will provide 580,000 tons more and plants going in without such certificates will further boost the total by 53,000 tons per year. All but a small fraction of this production will come from natural gas.

Chemical Award

Phillips gets high honor for synthetic-rubber work

NEW YORK. — Phillips Petroleum Co. last week was announced as winner of the 1951 Award for Chemical Engineering Achievement for its work in the commercial development of high-abrasion carbon black and cold rubber.

The award, given by Chemical Engineering magazine, will be presented during the week of the Chemical Exposition here November 28 at a subscription dinner in the Waldorf-Astoria Hotel.

An awards committee composed of 70 senior chemical-engineering educators over the United States selected Phillips for its contributions in the synthetic-rubber field which "tipped the balance from natural to synthetic rubber for tire treads." The committee said these contributions make the United States more nearly self-sufficient in rubber, contribute to the nation's defense, and insure low-cost transportation even if supplies of natural rubber should be cut off.

Alfred H. White, professor-emeritus of chemical engineering at University of Michigan and head of the awards committee, will make the presentation.

Carbon black.—Phillips began large-scale production of a new high-abrasion furnace black in 1948. This, said the committee, revolutionized the rubber industry in the United States.

Tire makers in 1948 were looking forward to the postwar return of natural rubber, but the advent of the new black in GR-S synthetic rubber produced tire treads equal or better than natural-rubber treads containing the best channel black. When combined with cold rubber, the new furnace black produced treads 30 to 50 per cent better than the natural product.

Phillips' blacks, produced in the world's biggest carbon-black plant near Borger, Tex., now account for 23 per cent of total furnace black and 48 per cent of oil-furnace black produced. Annual production of the new black there will soon be over 300,000,000 lb. and is expected by the middle of 1952 to climb to 750,000,000 lb.

Cold rubber.—In addition to its black contributions, the committee said, Phillips pioneered in the development of cold rubber. Here are some of the company's "firsts":

(1) Phillips designed and placed in operation the world's first refrigerated synthetic-rubber pilot plant; (2) produced the first pilot-plant quantities of cold rubber for testing in tires; (3) developed the "Custom"-type polymerization recipe now extensively used commercially to produce 41° F. cold rubber; (4) first produced experimentally "antifreeze" cold rubbers at temperatures as low as 0° F.; (5) first demonstrated that high-quality tire treads could be produced from polybutadiene rubber; (6) furnished chemical-engineering data for cold-rubber production and helped in the first commercial production of cold rubber at Baton Rouge; (7) introduced new organic initiators in cold-rubber production; (8) first combined cold rubber with high-abrasion furnace black; and (9) first inserted cooling coils directly into reactors to get rid of the heat of polymerization fast enough to cut cold-rubber production cycles in half.

Phillips also designed and built a plant making tertiary alkyl mercaptans, which are used to control plasticity of cold rubber during production, and the first plant to produce butadiene from n-butane by two-step hydrogenation.

Other oil winners.—The Chemical Engineering award, given this year for the eleventh time, has been won several times in past years by oil companies or related firms. In 1939 Standard Oil Development Co. won it for new processes for the production of better aviation fuels and other products synthesized from petroleum hydrocarbons.

Shell Development Co. received it in 1948 for the successful synthesis of glycerin from petroleum for the first time on a commercial scale.

Several oil firms participated in the award in 1943 which went to the American synthetic-rubber industry for putting together an efficient industry in less than 24 months—a project that normally would have required 12 years.

Progress Week On

Entire nation told of the many contributions of oil

THE entire nation was told this week that "your progress and oil progress go hand in hand."

This slogan was the principal theme of hundreds of Oil Progress Week celebrations throughout the country as oil men and women told their neighbors of their work and the ways in which petroleum products contribute to American living and prosperity.

The progress of petroleum—and of the nation—was universally attributed to the conditions which have shaped the industry's past and hold the hope for its future—free enterprise, the

competitive spirit, and the profit incentive. Without free enterprise, the nation was told in a thousand different ways, neither petroleum nor any other industry could expect much progress.

From coast to coast.—Leaders of the oil industry from coast to coast filled speaking engagements at gatherings of all sorts and so did hundreds of local oil men, for all branches of the industry cooperated in marking Oil Progress Week.

Heading the list was Frank M. Porter, president of the American Petroleum Institute, the organization in over-all charge of the week's activities. Journeying to Houston to address a special luncheon group, Porter declared that the oil industry is playing an important part in bolstering the courage of the American people in these critical times, saying:

"They recall its record in World Wars I and II. They are immeasurably heartened by this record, for even the least informed about events realize that oil is decisive in modern war. Though he may not know what Tito said to Stalin, the man on the street can tell you that the victories of modern war are won on the oil fields of this nation.

"Our nation's tremendous petroleum reserves are a comfort to the American people. But other reserves do even more to inspire faith in our country's invincible strength. These are the reserves of enterprise, of creative energy, of daring, of technical skill—and of capacity to serve, which are the glorious inborn distinctions of our free, competitive, progressive American petroleum industry.

Nothing like it.—"There is nothing else like it anywhere in the world—and that is why there is no country anywhere in the world that can match America in the productive arts of peace or the sciences of war."

Speeches, however, were only part of the activities. There were parades, window displays, exhibits, special newspaper editions, advertising, radio programs, movies, posters, billboards, and virtually every known device for disseminating information.

An interesting aspect of local planning and participation was the way in which many communities combined their oil message with contemporaneous local events. In this way oil crept into football games, community-fund drives, building dedications, and many other occasions during the week, as the participating oil men missed few opportunities in their campaign of adult education.

MID-CONTINENT

Water Flood Planned

Third crop of oil will be assured old Naval Reserve field of Osage County, Oklahoma, under new agreement

Joseph A. Kornfeld

A THIRD crop of oil from the old Naval Reserve field in Osage County, Oklahoma, is assured by completion of an agreement to start a water-flooding operation to replace a gas-injection program now nearing its end.

The Texas Co. will operate the flood for the 13 member companies and operators which have formed the Naval Reserve unit. Approval has been received from the Interior Department which has jurisdiction because the oil rights are owned by the Osage Indian Nation. Despite its name, the field is not a naval petroleum reserve.

Naval Reserve unit lies 7 miles southeast of the South Burbank unit, a gas-injection operation of long standing, and about 10 miles from the Mid-Burbank and North Burbank units, water-flooding operations. *(The Oil and Gas Journal, March 15, 1951, page 78, and April 19, 1951, page 132).*

Flooding benefits.—Production of 15,000,000 bbl. of high-gravity oil is expected to be obtained through the water-flooding program. Simple primary operations recovered an initial crop of 5,000,000 bbl.; this came from 1929, the field discovery date, to 1937. The second harvest, in the form of 17,000,000 bbl. from 1937 to the present, was due to gas injection augmenting primary operations.

However, in recent months, the supply of residue gas available for gas injection has dwindled and the field's output has declined to stripper-well status. The average well, in the 2,650-ft. Burbank sand, produces slightly more than 2 bbl. per day and the field's 273 oil wells yield only 650 bbl. daily.

Gas ahead of water.—Reservoir engineers believe that gas injection operations ahead of water-flooding in the stripper stage is desirable from a recovery standpoint. The other two floods in the western part of Osage Nation were preceded by gas injection of only limited extent. Success of water-flooding after injection at Naval Reserve unit would encourage similar operations in large Pennsylvanian sand reservoirs such as Glenn pool where low-pressure gas sweeps have been conducted successful by The Texas Co., Gulf Oil Corp., and Sinclair Oil & Gas Co. In solution in the Naval Reserve wells are an estimated 300 to 400 cu. ft. of gas per barrel of oil due to prior gas injection.

Unit formed.—After observing the water-flood operations at both North Burbank and Mid-Burbank units, 13 companies and operators in Naval Reserve field joined hands recently and signed an agreement petitioning the Osage Nation to approve a unit to conduct water-flooding in the latter field. Contained in the 4,960 acres outlining the unit are 2,735 productive and attributable acres.

Principal interests are held by The Texas Co., operator, with 58.6 per cent equity interest, Champlin Refining Co. with 12.8 per cent, and Continental Oil Co. which has 15.0 per cent. Minor interests are held by Sinclair Oil & Gas Co., Tide Water Associated Oil Co., Skelly Oil Co., Phillips Petroleum Co., B. A. Baker, William R. Breckenridge, Ann A. Breckenridge, and Byron V. Boone.

Equity factors for each company's interest were calculated by averaging the participation on the basis of number of producing acres, oil production for the year 1949, and cumulative oil production to January 1, 1950.

Pilot floods.—Two pilot floods will be started this month to evaluate concurrently well-injection characteristics, water-supply sources, and whether a peripheral or a pattern flood will be employed for full-scale injection operations.

Gravity injection will be tried out in a peripheral flood to be located on the west side of the field. A producing well will be converted to water-injection service through perforating the casings opposite shallow water sands and allowing the water to enter the producing reservoir through a tubing-packer arrangement. A fluid-flow meter will be inserted in the well setting to measure the volume of water passing into the oil sand. *(See The Oil and Gas Journal, November 1, 1947, page 60).* Location of water sand will be ascertained through well log data and from a radioactivity well-log survey to be run in the well.

Pattern flood.—In the south end of the field where the Burbank oil sand exhibits low permeability, The Texas Co. engineers plan to initiate a five-spot pattern flood. Engineers believe that pressure will be required to obtain fluid entry into the sand. A water-supply well will be drilled to the Arbuckle dolomite.

The more feasible of the two pilot floods will be expanded into larger flood operations for evaluation of flood performance. Included in the peripheral flood on the west side of the field would be five gravity-injection wells to be converted from oil wells. The proposed pattern-flood enlargement would embrace nine five-

spot input wells, including the well to be drilled.

Present plans for obtaining supply water are confined to subsurface sources, but the engineering committee is considering the feasibility of laying a line to the Arkansas River which passes within 7 miles of the field. Carbonation of flood water to increase oil recovery is another phase of water injection operations under study by the committee. *(The Oil and Gas Journal, May 3, 1951, page 53).*

Prior gas injection.—Naval Reserve field, discovered in 1929, after a slow start reached its peak during 1935 when output soared to about 8,380 bbl. daily. Two years later, when a supply of residue gas was available from nearby gasoline plants, the field operators initiated a voluntary, cooperative secondary-recovery program. A total of 30 Burbank sand oil wells were converted to input service and an average of 2,000 M.c.f. of gas per day was returned to the Burbank reservoir under a surface pressure of 240 psi. The original reservoir pressure was about 800 psi.

Kansas Flood Tour

300 oil operators inspect Greenwood County projects

EUREKA, Kans.—The possibility that 100,000,000 bbl. of crude oil will be recovered by water-flooding operations in Greenwood County, Kansas, was brought out during a tour of several successful water-flood projects sponsored by the Kansas section of the American Institute of Mining and Metallurgical Engineers and the Kansas-Oklahoma water-flood operators last week.

This tour, attended by over 300 operators, visited Bartlesville sand water-flood projects in Thrall-Agard, Teeter, and Polhamus fields, of Greenwood County.

These engineers responsible for the tour pointed out that at present water-flood projects in and immediately adjacent to Greenwood County have an annual production of about 5,000,000 bbl. of oil from a total developed area of almost 10,000 acres. They showed that the potential floodable area of the projects now in progress is over 15,000 acres and that it has been estimated that an additional 5,000 acres are floodable.

Estimated recovery.—Noting that several of the projects have had a water-flood recovery of more than 6,000 bbl. per acre, the engineers said that an estimated ultimate water-flood recovery of 100,000,000 bbl. was indicated by using an average water-flood recovery of 5,000 bbl. per acre.

Statistics given to those participating in the tour, showed that an estimated 20,000,000 bbl. of oil have been recovered by water flood up to July 1 as a result of injecting 163,000,000 bbl. of water.

The leases visited on the tour served as examples of some of the various methods for obtaining and handling the enormous volumes of water needed for flooding. Many of the water-flood projects in Greenwood County have used water from the Douglas although many of the newer projects are using Arbuckle and surface water.

New Unit Operating

Gas injection is started at Northeast Elmore pool

PAULS VALLEY, Okla.—Carter Oil Co. has started full-scale gas-injection activities at the Third Deese unit in Northeast Elmore pool near here. The original unit of 83 wells was formed in January.

Pressure-maintenance operations are expected to boost the anticipated ultimate recovery to 10,000,000 bbl. of oil from the primary recovery estimate of 8,000,000 bbl. To January 1, the field produced 5,234,352 bbl. of stock-tank oil and 13,159,000,000 cu. ft. of gas from 104 producing oil wells. Accumulative gas-oil ratio for the field is 2,514 cu. ft. per barrel.

Gas from low-pressure separators is collected through an extensive field gas-gathering system and a stream of 10,000,000 cu. ft. daily is delivered to the Antioch gasoline plant of Warren Petroleum Corp., under contract between Carter and the Garvin County Gasoline Plants.

Returned to plant.—Residue gas leaving the Antioch plant is compressed to 500 psi. and returned to the Elmore unit plant, where it joins a stream of lean high-pressure separator gas collected through a second gas-gathering system. The combined 19,000,000 cu. ft. stream is returned to the Third Deese sand reservoir through six injection wells.

Other interests are held by Phillips Petroleum Co., Superior Oil Co., Anderson-Prichard Oil Corp., British-American Oil Producing Co., Deep Rock Oil Corp., Globe Oil & Refining Co., Kerr-McGee Oil Industries, Inc., Magnolia Petroleum Co., Mid-Continent Petroleum Corp., Max Pray, Sinclair Oil & Gas Co., Sun Oil Co., Tide Water Associated Oil Co., Vickers Petroleum Co., Inc., Charles B. Wrightsman, and Zephyr Petroleum Co.

***PLANNED TOUR.**—Some of the men responsible for the success of the Greenwood County water flood tour. Left to right: Ward Clark, W. A. McGinnis; Lawrence Holsapple, Sinclair Oil & Gas Co.; Ed Arnold, Phillips Petroleum Co.; Bill Lane, Sohio Petroleum Co.; Harlan Scott, Ohio Oil Co.; and Bob Medaris, Phillips.*

GULF COAST

Good Area for Gas

Gulf Coast to see major discoveries, Davis says

HOUSTON.—A large percentage of future discoveries of natural gas in this country will be in the Gulf Coast area, including the offshore portion, it is evident from a study of the volume of sedimentary formations yet to be tested and the known character of those sediments, according to Ralph E. Davis, Houston consulting engineer.

The next most promising area for large gas discoveries is the Permian basin, Davis said, followed by the Anadarko basin. Davis, who is considered an outstanding authority on the subject of gas reserves, is the author of a recent paper on methods of estimating gas reserves *(The Oil and Gas Journal, September 27, 1951, page 103)* in which he discussed the probable producing capacities of a number of areas of the United States.

The Gulf Coast area of Texas and Louisiana, with its 65 trillion cubic feet of proven gas reserves represents 35 per cent of the total United States reserves, Davis said, and the increase in reserves in 1950 in this area was almost 3 trillion cubic feet of a total increase for the nation of 5.2 trillion cubic feet.

Future outlook. — Discussing the future outlook for gas supply for the country as a whole, Davis said:

"The national proven gas reserve, 185.5 trillion cubic feet, is at an all-time high. Also at an all-time high, however, is the gas-producing rate, which was approximately 6.9 trillion cubic feet during 1950. Calculated in terms of supply, we find that as of January 1, 1950, the reserve constituted the equivalent of a 29-year supply at the 1949 producing rate, but the proven reserve as of January 1, 1951, amounted to the equivalent of only a 26.9-year supply at the 1950 rate.

"The term 'amounted to the equivalent' is used in an effort to make it clear that although the simple arithmetic represents such a relation, it is not to be expected that production can be had at a nondeclining rate until reserves are exhausted. More time will be required, and eventually at declining rates.

Production.—"To the end of 1950, the natural gas produced in the United States amounted to an estimated 165 trillion cubic feet, nearly as much as the estimated present total proven reserves. Adding the present proven reserve makes the total volume of gas discovered to date 350 trillion cubic feet. A great deal of gas will yet be discovered. A conservative estimate would be perhaps 100 to 200 more trillion cubic feet. Since we cannot be sure, however, of the reserves yet to be found, the supply which we now have of this essential natural resource should be treated with care."

CANADA

U. S. Plant Takes Canada Oil

CLEVELAND.—The first cargo of Canadian crude to reach an American refinery by lake tanker was delivered last week.

The S. S. Comet, a Cleveland Tankers, Inc., vessel, loaded about 32,000 bbl. of 33°-gravity Canadian Redwater crude at the eastern terminus of Interprovincial Pipe Line Co.'s system at Edmonton, Alta., and delivered it to Old Dutch Refining Co.'s plant at Muskegon, Mich.

Old Dutch Refining reports that the Canadian crude, delivered by water, compares favorably in price with the delivered price of American Mid-Continent crude at Muskegon.

Interprovincial Expanding

TORONTO. — Interprovincial Pipe Line Co. is going ahead with an expansion of its system which will increase capacity from Edmonton to a maximum potential of 146,000 bbl. of crude per day by the end of 1952.

Capacity into Superior, Wis., when the program is completed, will be 95,000 bbl. per day.

Interprovincial is now adding five pump stations to its system plus an additional 2,600,000 bbl. of storage at Superior which will raise tankage capacity there to 4,400,000 bbl. The work will be completed by the time the Great Lakes are open to navigation in 1952. This construction will provide ample capacity to take care of a peak summer movement out of Edmonton of about 113,000 bbl. per day. Year-around average due to the closed-navigation season will average about 100,000 bbl.

This year Interprovincial will deliver about 13,000,000 bbl. of crude to Superior for tanker movement to the Ontario markets. This will increase in 1952 to about 18,000,000 bbl.

In 1952, the company will loop about 100 miles of the 16-in. section of the system from Regina to the United States-Canadian border. It will also build another pump station at Deer River, Minn., and build more storage to bring available tankage up to 7,000,000 bbl.

The 95,000 bbl. planned for delivery into Superior when construction is completed in 1952 will depend upon the availability of tankers, since this potential is in excess of tanker-carrying capacity on the lakes at present.

Industry Briefs

MIAMI, Fla. — Commonwealth Oil Co. has been granted 10-year leases of 885,000 acres of state-owned tidelands along the extreme northwest coast of Florida on a cash bid of $10,500. Lands include 665,000 acres of offshore lands and 220,000 acres of intercoastal bays, sounds, and bayous. At least one well must be drilled within 6 months in the leased area which is in or adjacent to Escambia, Santa Rosa, Okaloosa, Walton, Bay, and Gulf counties.

TULSA.—Informal ground-breaking ceremonies launched construction of Stanolind Oil & Gas Co.'s new multi-million-dollar research center here last week. More than $1,000,000 in equipment has been purchased to augment present equipment for the $4,000,000 quadrangle of buildings. Contractor estimates the center should be completed in 18 months.

WASHINGTON.—Crude buyers and purchasers in certain areas who have been in a pinch since their prices were frozen at subnormal levels may get relief under a new Office of Price Administration regulation effective October 9. It provides for adjustment of out-of-line ceilings on crude of comparable grades in fields or pools within the same producing area. OPS, after examining an application for relief, may approve, disapprove, or establish a substitute price.

MOBILE, Ala.—Gulf Refining Co. has applied to the Army Engineers for a navigation permit to erect an offshore drilling barge to sink the first actual oil test in Mobile Bay. Gulf has been making seismic surveys for the past year. The well would be located 22 miles south of Mobile.

WASHINGTON. — James A. Reid, assistant director of research and development for Phillips Petroleum Co. on loan to the Reconstruction Finance Corp. where he has been director of production, has been made technical director of production, handling the scientific and technical phases. Arthur S. Barrows, former undersecretary of the Air Force and formerly president of Sears-Roebuck & Co., has been brought in as director of production, handling the business side.

AUSTIN.—Regulations for oil fields extending into both Texas and New Mexico will be determined at a joint hearing of the Texas Railroad Commission and the New Mexico Oil Conservation Commission October 25 at Santa Fe, N. M.

WASHINGTON.—O. V. Tracy, manager of the chemical-products division of Esso Standard Oil Co., has been named deputy director of the chemical division of the National Production Authority and is expected to become director of the division when Kenneth Klipstein, present head, is advanced to the post of deputy administrator.

PONCA CITY.—A new three-story laboratory building for Continental Oil Co. will be completed here this fall. The $2,250,000 structure will be joined to an existing two-story administration building by a new two-story building, the company reported. Total floor area to be added by the new laboratory will be approximately 40,800 sq. ft.

WASHINGTON. — The present "9,000" series list of approved lubricating oils will be abandoned by the Navy Bureau of Ships after contract committments of the current fiscal year have been met. Higher sulfur fuels, the Navy has found, plus more severe engine operating conditions and new materials and types of engine construction have imposed such severe burdens on the lubricating oil that retention of the present specifications is untenable. New specifications to meet minimum Navy standards are expected to be developed.

ONE OF MANY.—Members of an Arabian American Oil Co. survey party grouped around a number of the firm's DC-3's on an air strip near Al Kharj, Saudi Arabia. The company has 16 planes, including several four-engine craft and smaller planes.

MIDDLE EAST

Aramco's Air Fleet

The largest private user of aircraft, Arabian American now has 16 planes, 4 more on order to handle operations

Dahl M. Duff

DHAHRAN, Saudi Arabia.—Arabian American Oil Co. is the largest private user of aircraft aside from the airlines themselves. The company makes maximum use of air transportation as both a necessity and a convenience in the desert of Saudi Arabia.

The company's aviation department is comparable in size to a fair-sized airline. It has 16 aircraft with four more on order. Besides the primary function of hauling passengers and cargo, it carries out various other tasks such as pipe-line patrols, aerial reconnaissance, desert searches, and on occasion spotting schools of fish in the Persian Gulf for the Saudi Arabian Government.

Within the company, the aviation activities have come to be more or less taken for granted. For Aramco, it is a side line and only one of a number of incidentals required to support the end operation of finding and producing oil.

The company's total investment in aviation approximates $4,000,000, about half of which is represented by the planes and half by the hangers, shops, and other facilities at the Dhahran, Saudi Arabia, base. The use of aircraft by Aramco has been on the upgrade along with the growth of the company, and is now two to three times what it was 3 years ago.

Other than the regular airlines, Aramco is the only private company making regularly scheduled trans-ocean flights. It operates two four-engined DC-4's between New York and Dhahran. These flights allow it to carry well over half the company employes and their dependents traveling to or from the United States. The remainder use commercial airline or ship.

Frequent trips.—The trans-Atlantic planes make six round trips a month. To serve them, the company has four complete crews, each consisting of a five-man technical crew and two cabin attendants. Two of the heavier, pressurized DC-6B's are on order, and when these planes are delivered next summer, present plans are to use three aircraft in trans-Atlantic service, including the two new ones and one of the DC-4's.

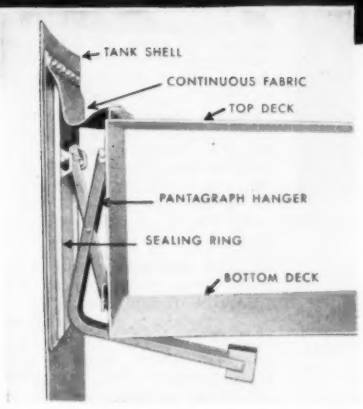
A particularly interesting aspect of the trans-Atlantic flights is the adaptation of one of the planes to carry high-pressure well-fluid samples to the United States. Regulations of commercial airlines prohibit this general type of cargo. Aramco's aviation department took the normally hollow wing section near the fuselage of one of the DC-4's and converted it to a small cargo compartment. The result met Civil Aeronautics Administration requirements and allows quick delivery of the samples to laboratories in the United States.

One of the DC-4's is equipped to carry either passenger or cargo. This plane is frequently used to carry urgently needed priority equipment to the field from either the United States or Europe. It is this DC-4 that the company expects to continue in service after the new planes are received next summer.

All the other Aramco airplanes operate out of Dhahran except for

AVIATION OFFICIALS.—Aramco's aviation-department officials, photographed in Arabia by the Journal's international editor, Dahl Duff. Left to right: R. E. Ryan, maintenance superintendent, Dhahran; George Kraigher, department manager, New York; and R. F. Morris, operations manager, Dhahran.

THE HORTON SEAL



Cutaway view showing the operation of the Horton Seal. Notice the effective closure with a minimum number of parts. This means longer—trouble-free life.

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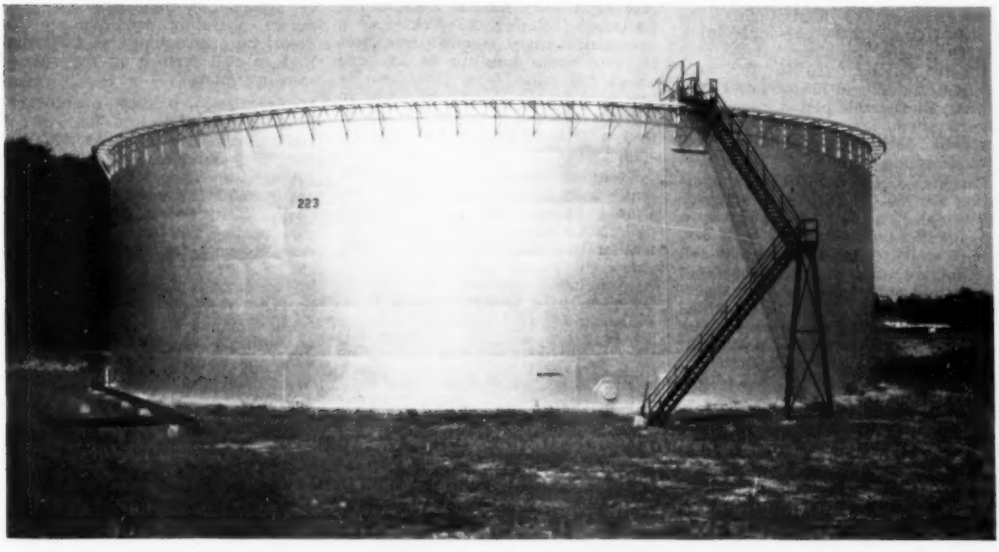
The Horton Seal is a standard construction on all three types of Horton Floating Roofs—Pan, Pontoon, and Double Deck. For more information, write or call our nearest office listed below. There is no obligation on your part.



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Birmingham, 1.....1536 North 50th St.
Boston, 10.....1025-201 Devonshire St.
Chicago, 4.....2128 McCormick Bldg.
Cleveland, 15.....2204 Guildhall Bldg.
Detroit, 26.....1514 Lafayette Bldg.
Houston, 2.....2119 National Standard Bldg.
Los Angeles, 17.....1523 General Petroleum Bldg.
New York, 6.....3347–165 Broadway Bldg.
Philadelphia, 3.....1615–1700 Walnut Street Bldg.
Salt Lake City, 4.....525 West 17th South St.
San Francisco, 4.....1544–200 Bush St.
Seattle, 1.....1325 Henry Bldg.
Tulsa, 3.....1606 Hunt Bldg.
Washington 6, D. C.....1139 Cafritz Bldg.

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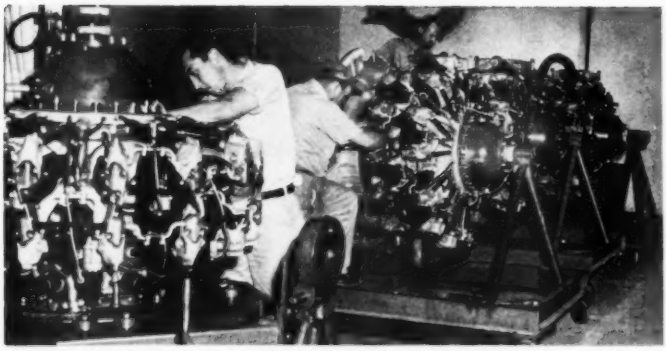
Sociedade Chibridge de Construcoes Ltda., Av. Franklin Roosevelt, 194-S/704-C, Rio de Janeiro, Brazil
Comprimo N.V., Amsterdam—O, Netherlands
Compagnia Tecnica Industrie Petroli, Rome, Italy
Whessoe, Limited, Darlington, England
Motherwell Bridge & Engineering Company, Limited, Motherwell, Scotland



MAINTENANCE SHOP.—These skilled Aramco mechanics are at work on plane engines in the modern shop at Dhahran, Saudi Arabia.

two twin-engined Beechcrafts which are stationed at Beruit, the Mediterranean terminus of the trans-Atlantic pipe line. Based at Dhahran are 12 planes, 7 of them twin-engined DC-3's and the remainder single-engined Navions. Field facilities at Dhahran include two 125 by 150-ft. steel hangers, maintenance shops, offices, and stockrooms.

Performance.—During one recent normal month, the planes operating out of Dhahran turned in the following performance: 163 total flights, 760 hours' flying, 702,000 passenger-miles, 42,000 freight ton-miles; 2,000 passengers carried, 245,000 lb. total freight carried, and 105,000 miles total flown. During this period, plane load factor or the ratio of load to total potential load on the flights made, was 47 per cent.

Backbone of the Dhahran air operation are the DC-3's which can carry 25 persons, 3 tons of cargo, or a combination of both. The light Navions, which carry three persons and a pilot are used primarily for rapid movement of personnel and the three-times-a-week patrol of the Tapline. These airplanes are on some occasions used to haul the equivalent weight of about 600 lb. of small cargo.

Crews rotated.—Aramco regularly rotates its more isolated drilling crews as well as the exploration parties. These changes are habitually made by air. In September, the company begins its exploration season, and geophysical and structural drill parties move out to the more distant parts of the concession area. Supply is partially by air. Party equipment includes a radio homing beacon which allows the pilot to fly direct to the location. Parties also carry wind socks, and a landing strip is marked off by making truck tracks along a suitable stretch of level compact sand. Often gravel areas where the sand cover has been moved by the wind, are used for landing strips.

Desert searches.—Occasionally Aramco's aviation department is called on to make a desert search. These occur when a vehicle loses its way in an unmarked area or has a breakdown. Except in a sandstorm, stranded trucks are easily spotted from the air. In emergency cases, the plane can drop food, water, and medical supplies by parachute. Ground relief parties can be directed to the area.

Another important use of aircraft in the company is the rapid movement of injured personnel. One normal day's work for the aviation department included the pickup of a geophysical-party member who was ill with acute tonsilitis in an area about 250 miles from Dhahran. He was back in the hospital at Dhahran 5 hours after his case had been reported by radio from the party location.

Occasionally one of the DC-4's make a straight-through trip to the United States with an emergency patient needing special medical attention. In such a case, only refueling stops are made, and with present four-engined equipment, the trip can be made in 36 hours elapsed time. When the DC-6B's are placed in service, it will be possible to reduce this time to about 27 hours.

The other two Aramco planes on order are Convairs. These twin-engined aircraft will be used to supplement the present fleet of DC-3's at Dhahran. At present, the DC-3's are making more than 20 scheduled flights weekly carrying passengers, cargo, or most usually both.

Regular flights.—Two flights daily are made to carry company personnel to and from Bahrein. A weekly trip is flown to Jiddah, Saudi Arabia, and Asmara, Eritrea. Two trips weekly are made to Ras el Misha'ab and the pipe-line station at Nariya. Other scheduled flights include four round trips to Beruit. These latter are known within the company as the Tapline "milk run" where stops are made at each of the pump stations for mail, priority cargo, and personnel needing medical attention or being rotated.

In addition to these scheduled flights, the planes make frequent unscheduled special trips. At Dhahran, the aviation department has one or more planes ready to fly on call 24 hours a day.

The full-strength complement of the aviation department at Dhahran includes 25 pilots, all Americans. The maintenance group consists of 37 Americans, 21 Indians, 2 Italians, and 15 Arab trainees. These are 12 others, including 2 Palestinian Arabs, in the administrative and dispatcher classification. The Dhahran landing field itself is controlled by the U. S. Air Force, which maintains the base under a newly extended 5-year agreement with the Saudi Arabian Government.

No bad accidents. — Although there have been a few forced landings, Aramco's flying record is free of serious accidents. Safety receives continuing emphasis. The aviation department prides itself on "airlines-plus" procedure, meaning conformity to accepted practice but usually with a further factor as an additional safety precaution. For example, the engine of a DC-3 is in most cases given a major disassembly and overhaul at the end of 1,000 hours. Aramco has cut this figure to 800 hours, partly because of the somewhat more severe operating conditions in the desert but also because of the policy to lean still farther on the side of safe operation.

Maintenance. — Aircraft maintenance in Saudi Arabia, despite its heat and sand, is not as difficult as might be imagined. Sand causes trouble with rubber seals and washers, and tires are sometimes damaged in landing on the rocky terrain in the northern part of the country. Filters require more frequent cleaning. Outside these and a few other minor problems, maintenance is much the same as in the United States.

The company's shops at Dhahran are equipped to perform virtually all maintenance work except for some of the more highly technical repairs on instruments. The parts stockrooms contain some 6,000 separate items. Repair facilities include shops for welding and painting, magniflux flaw detection, carburetor testing, and radio work. The magniflux equipment is occasionally used for testing other company equipment, as for example, crankshafts.

Aramco's aviation officials, headed by George Kraigher, manager, feel that flying conditions in Saudi Arabia are certainly no worse and possibly even better from some standpoints, than in other parts of the world. Sandstorms can make flying difficult but there is no snow or ice. One advantage in Saudi Arabia lies in the fact that a landing area can be prepared with little trouble in most parts of the country.

No Compromise in Iran

Peaceful settlement of questions raised by Iranian oil nationalization appears remote; leaders go before U.N.

Ted A. Armstrong

THE road toward a peaceful settlement of the questions raised by Iran's expropriation of all oil facilities grew rockier this week.

Attempts of bystanders to smooth out the difficulties and get Britons and Iranians together again over a conference table were unavailing, and Iran told the world she does not plan to compromise.

Addressing the Security Council of the United Nations, Premier Mohammed Mossadegh declared his country to be still "willing to reopen negotiations," but only over the fixing of compensation to be paid Anglo-Iranian Oil Co., Ltd., and over Iran's proposed sale of its oil to the British.

At the same time, he told the council there was no justification for its intervention in the British-Iranian dispute. His position all along has been that the issues are merely questions raised between the Government of Iran and an oil company operating within that country and therefore are outside the attention of the U.N.

Russian plan cited.—Mossadegh also mentioned that Russia had proposed the formation of a Russo-Iranian oil company to replace Anglo-Iranian, but said the plan had been rejected.

Iran's present economic situation, Mossadegh said, may soon force disintegration of the government. That the loss of the oil revenue has hit the country hard was echoed by Huessin Fatimi, Mossadegh's assistant, who said in a press conference this week Iran is ready now to begin selling oil, regardless of the unsettled questions with Britain.

As a result of the oil-industry collapse and the end to the government's income, Fatimi said, unemployment and poverty have covered Iran.

"The Government of Iran is resolved to exploit its oil immediately. Since there is no sign of good will from the other side, we do not think any recommendation for the resumption of negotiations would bring any useful result."

Settlement plans.—One of the most unusual plans for ending the Iranian shutdown was advanced last week by former Secretary of the Treasury Henry Morganthau, Jr.

Morganthau proposed to U.N. Secretary General Trygve Lie that the U.N. create an authority to buy the British Government's interest in Anglo-Iranian Oil Co., Ltd. The government owns 53 per cent of the company.

Morganthau suggested the plan be financed by bonds issued by the International Bank for Reconstruction and Development, with a long-term contract for Iran's oil to serve as collateral for the bond issue.

The former treasury head said his plan would keep Iranian oil away from Russia, show the world the U.N. could meet any situation which might arise in the field of economics, end the depletion of United States fields caused by current high exports to make up the loss of oil in Iran, save United States taxpayers millions which would be poured into Iran to maintain her independence, provide an "out" for both England and Iran in the heated controversy, and provide the U.N. with profits of such magnitude to "go a long way" toward financing the United Nations.

Another proposal came from the International Cooperative Petroleum Association in Stockholm, which said it will offer to help Iran achieve international management of its oil industry.

A Stockholm announcement said Albin Johansson, association president now in the United States, and Howard Cowden, president of Consumers Cooperative Associated, Kansas City, Mo., together would propose a plan to create a world-wide cooperative association to handle distribution of Iranian oil.

Cowden, the announcement said, already had presented the plan to President Truman as a suggested "mediation program."

Other events.—Britain last week again entered the International Court of Justice in The Hague over the Iranian situation.

A memorandum asked the court to do one of three things: Order full restitution of the oil properties to Anglo-Iranian; if this is impossible, rule the Iranian nationalization illegal and order compensation on this basis, including indemnity for loss of future profits; if nationalization is held lawful, order compensation paid for the expropriated properties.

In England, the handling of the Iranian expropriation continued to be the major argument of Winston Churchill and his followers in preparation for the coming election.

Events in the Near East, Churchill said, are an example of how the free world might crumble if Britain continues to have an unstable government.

There also was criticism of the government for keeping secret the last offer of the Iranian Government to settle the controversy. In this offer, disclosed last week, Iran said it would be willing to rehire Anglo-Iranian technicians at their old salaries, accept a "foreign" director of the industry to be chosen by Iran, pay legitimate claims to the company for its properties, and sell Britain as much oil as she obtained from Iran in previous years and at world market prices.

(Additional International News will be found on page 200).

***VISITOR FROM IRAN.**—Prime Minister Mohammed Mossadegh, 72 and ailing, as he read a prepared statement to reporters in New York last week. At left is Nasrollah Entezam, Iran's chief delegate to the United Nations and president of the general assembly, and at right is Aassadi Mahsen, U.N. delegation member, who translated Mossadegh's remarks. Mossadegh is living in New York Hospital during his 3-week visit to the United States.*

*

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PERSONALS

New Post

Hinton named American Republics vice president

C. M. HINTON, manager of the production department of American Republics Corp., Houston, has been elected vice president in charge of producing operations. In this newly created job Hinton will coordinate and supervise all of the drilling and producing operations, as well as gasoline-plant operations, purchasing, traffic, and production sales.

A graduate of the Missouri School of Mines, Hinton was associated with The Texas Co. for 12 years in its operating department, and served as production foreman, general foreman, and assistant petroleum engineer. He also served a year as assistant manager of Texaco Exploration Co., in charge of drilling and production at Calgary, Alta., Canada. He joined American Republics in June 1949 as manager of its production department.

Hinton is a member of the Independent Petroleum Association of America, American Petroleum Institute, and American Institute of Mining and Metallurgical Engineers.

F. E. Caddy, formerly superintendent of Shell Chemical Corp.'s Houston plant, has been named manager of the firm's plant in Martinez, Calif., succeeding **O. M. Williams,** who has been made assistant to the vice president in charge of manufacturing in New York.

H. O. Miller has been appointed senior development geologist for The California Co. in New Orleans. **C. A. Christensen** has been appointed division construction engineer in the North Louisiana and Mississippi division, and **C. J. Courtney** has been advanced to division development geologist in the Gulf Coast division.

H. R. Shannon has been appointed production superintendent for Carter Oil Co.'s Northwest division with headquarters in Denver. **J. L. Rogers** has been appointed Central division superintendent for the firm at Oklahoma City, succeeding Shannon. **Roger S. Frazier** has been transferred from Oklahoma City to Denver as division petroleum engineer for Carter's Northwest division, and **R. B. Chapman,** of Tulsa, has been named assistant division engineer in Oklahoma City succeeding Frazier. **H. L. Spillers,** district superintendent at Seminole, Okla., has been transferred to Oklahoma City as assistant division superintendent. Shannon, who has been with the firm for the past 26 years, has been in charge of operations in Oklahoma and Kansas the past 4 years. Rogers has been with the firm since 1935 and has been assistant division superintendent in Oklahoma City since 1948.

L. B. Culligan, geologist for The California Co., has been transferred from Ardmore, Okla., to Shreveport in the same capacity.

Marvin L. Brown has been appointed superintendent of production for the Canadian division of Sun Oil Co. with headquarters in Calgary, Alta. He was formerly regional superintendent of production for the firm's southwestern division at Dallas and in his new position succeeds **George E. Bentley,** who resigned to accept an administrative post with a newly organized drilling company. Brown joined the firm in 1919 as a roustabout.

J. J. Coates has been appointed general foreman of catalytic cracking at the Baton Rouge refinery of Esso Standard Oil Co. Other changes made in accordance with the firm's plan for rotational assignments of department heads include: **Dr. D. F. Edwards,** assistant process superintendent in the petroleum-products division; **Fred Kring, Jr.,** superintendent of the paraffin and lubricating division; **D. O. Swan,** superintendent of the refining and oil-movement division; **Harry Ottinger,** formerly in chemical technical service, assigned to cost analysis; **C. B. Moore** succeeds Ottinger; **D. B. Hile,** formerly in petroleum technical service, transferred to process engineers; **Robert E. Lee, Jr.,** formerly in mechanical-engineering department, transferred to the technical division; and **W. R. Thayer,** formerly in the technical division, assigned to the mechanical technical-service group.

O. N. Knox, a veteran of 33 years in Carter Oil Co.'s production department at Tulsa, has been named general superintendent. He succeeds **W. A. Watkins,** who recently was appointed assistant to **F. M. Darrough,** Tulsa, general counsel and vice president. Knox has served as assistant general superintendent and previously had been central-division superintendent with headquarters at Seminole, Okla.

Harry S. Brigham, superintendent for Western Gulf Oil Co. at Bakersfield, Calif., left recently for Maracaibo, Venezuela. He will be there about 2 months on a special assignment with Mene Grande Oil Co.

Harry W. Bass, Dallas independent oil operator, was elected vice president of the newly created North Central Texas district of the Texas Mid-Continent Oil and Gas Association at the annual meeting in Beaumont October 8-9. **Arch H. Rowan,** Fort **Worth** independent operator, and **J. A. Neath,** vice president of Humble Oil

H. W. BASS

A. H. ROWAN

J. A. NEATH

& Refining Co., Houston, were presented plaques for distinguished service to the industry. Rowan is chairman of the board of Rowan Drilling Co. Neath since 1919 has been with Humble, and was elected vice president in 1947.

George P. Livermore, formerly president of two Lubbock, Tex., oil firms, George P. Livermore, Inc., and Great Western Producers, Inc., has organized George P. Livermore Oil Co.

J. A. Hapke, formerly superintendent of the light-oil division in Standard Oil Co. of California's El Segundo refinery, has been advanced to manager of the service divisions. **C. D. Lewis,** formerly assistant superintendent of the package and utility division, has taken over Hapke's former position. **P. N. Johnson** is the new assistant superintendent, and **C. D.**

PERSONALS

Barker has taken over Johnson's old job as superintendent of organization and cost control.

Harry G. Taylor, Jr., has been appointed head of the crude-oil supply and disposition branch of Gulf Oil Corp.'s production department at Pittsburgh. He joined the firm in 1921, and, prior to this appointment, was acting head of the department.

S. G. LOY

S. G. Loy has been elected to the board of directors of Humble Pipe Line Co., replacing the late L. E. Grissom. **E. L. Krueger** has been elected secretary and assistant treasurer, and **Horace F. Taylor** has been elected assistant secretary. Loy, controller of Humble since 1941, has been with the firm since 1919. Krueger was

E. L. KRUEGER

H. F. TAYLOR

made assistant to the treasurer in 1946, and was named assistant secretary and assistant treasurer in 1949. Taylor joined the firm in 1933 as pipe liner and was named chief clerk in crude-oil dispatching in 1945.

Chester A. Baird, Jr., has joined Gulf Oil Corp.'s subsidiary, Mene Grande Oil Co., as geologist and is headquartered in eastern Venezuela. **Chester A. Baird,** his father, recently retired from Gulf after 23 years of service, all connected with its foreign-production operations.

Richard D. Mullineaux, who recently received his Ph.D. in organic chemistry from University of Wisconsin, has joined the staff of Shell Development Co. **Ross E. Van Dyke,** formerly instructor in chemistry at Johns-Hopkins University, has joined the staff and is working in the colloid-chemistry field. **John A. Buckland** and **Howland A. Larsen** have also joined the firm. Buckland recently received his Ph.D. in chemical engineering from Pennsylvania State College, and Larsen holds a M.S. in chemical engineering from University of Illinois.

Nathan Berkman and **Sam B. Griffith** have organized B. & G. Oil Co. with offices at Evansville, Ind. Berkman is president and Griffith vice president.

Charlie McCamic, of Wheeling, W. Va., has been named president of the newly organized Northeast Mississippi Oil Co., and **Malcolm N. McCaskill,** manager of the firm's office at Aberdeen, Miss.

N. L. MacLeod and **Andy Gardner,** section supervisors at Socony-Vacuum Oil Co.'s Paulsboro, N. J., refinery, have been promoted to general foremen.

John B. Murvin and **Elmer J. Stebber,** independent oil operators, have formed a partnership at Noble, Ill. **George F. Yunck,** independent consultant at Olney, Ill., handles most of their geological work.

Walter G. Johnson, of Michigan City, Ind., and **Glen Patrick,** geologists for Producers Corp. of Nevada, San Antonio, Tex., have been elected directors and vice president of the firm.

E. S. Pennebaker, Jr., senior engineer for Humble Oil & Refining Co. at Houston, has been transferred to Kingsville, Tex., and promoted to district petroleum engineer.

Dean Chase, formerly assistant division superintendent for Phillips Petroleum Co. at Midland, Tex., has joined Lario Oil & Gas Co. there as division production superintendent for the Permian basin territory of West Texas and Southeast New Mexico. He had been with Phillips for about 19 years, working in the Permian basin area for 7 years.

A. D. Slover has been promoted to district geologist with Honolulu Oil Corp. in the firm's Midland, Tex., office.

F. A. Davies and **B. B. Howard** have been elected to the board of directors of Arabian American Oil Co. Davies, who is executive vice president of the company, has his headquarters in Dhahran, Saudi Arabia. Howard replaces **John R. Suman,** who has resigned from the board.

D. L. Wolfe, vice president of Stanolind Oil Purchasing Co., has been elected executive vice president, and **C. G. Irsch,** director in charge of accounting and finance, was elected financial vice president.

Osgood V. Tracy has been appointed deputy director of the chemical division of the National Production Authority. Tracy is on leave from his position as general manager of the chemical- products department of Esso Standard Oil Co. He formerly was manager of operations of Standard Oil Development Co. and manufacturing coordinator of chemical products for Esso Standard.

Alan Harrop, formerly general superintendent of Imperial Oil, Ltd.'s, Montreal East refinery, has been named manager of the firm's employee-relations department at Toronto. He is succeeded at Montreal East by **D. S. Simmons,** who was formerly manager of the engineering division at Sarnia, Ont. Simmons is succeeded by **R. W. Dunlop,** formerly assistant manager of the division.

GET AWARDS.—Awards were presented to members of the Spindletop Commission for their work in the year-long observance of the fiftieth anniversary of Spindletop oil field. R. B. Anderson, president of the Texas Mid-Continent Oil and Gas Association, presented the awards at the organization's annual meeting in Beaumont, Tex., last week. Left to right: Phil S. Justice, Sun Oil Co.; W. W. Leach, Magnolia Petroleum Co.; John W. Newton, Magnolia Petroleum Co., chairman; Anderson, Scott W. Myers, independent operator, Beaumont; and C. W. Cooper, Pure Oil Co.

PERSONALS

Robert B. Ogden has been appointed manager of the foreign-shipping department of Socony-Vacuum Oil Co., Inc., effective November 1. Ogden now is manager of the operations division of the firm's manufacturing department in New York. He succeeds the late **L. R. Owen.**

Sherman D. Archbold has been appointed general manager of the inland-waterways department of Esso Standard Oil Co., effective November 1, to succeed **R. G. Kimball,** who is retiring. **Fred S. Aldridge** has been named assistant general manager. Archbold has been assistant manager of the department since 1945.

E. R. Osburn, who recently retired as assistant general manager of Texas Pipe Line Co. and Texas - New Mexico Pipe Line Co., has moved from Houston to Midland, Tex., as a consultant for pipe-line design and construction.

Gene Caperton has resigned as petroleum engineer for Morton Oil Co. and has opened offices as engineering consultant in well drilling and completion activities in Casper, Wyo. He was formerly engineer with Stanolind Oil & Gas Co. before joining Morton in 1948.

Donald L. Barger has been appointed assistant superintendent of production and transmission for New York State Natural Gas Corp. He joined the firm in 1935, became a junior civil engineer in 1944, and served as assistant superintendent in the Armstrong, Pa., district until 1948 when he was made superintendent in the area.

Ralph J. Bertolacini, graduate of Michigan State College, has joined the technical staff of the Whiting Research Laboratories of Standard Oil Co. (Ind.). Other recent additions to the technical staff and the colleges from which they graduated include: **Jarvis B. Beverly,** University of Texas, recently associated with Shell Oil Co.; **Cecil G. Brannen,** Iowa State College; **Robert L. Chilenskas,** University of Illinois, recently associated with Monsanto Chemical Co.; **Donald R. Coughanowr,** University of Pennsylvania; **Lowell T. Crews,** Oklahoma A. & M. College; **Robert H. Crowther,** Kansas State College; **Kenneth L. Dudek,** Northwestern University; **Edward B. Eriksen,** University of Michigan; **John B. Malloy,** Massachusetts Institute of Technology; **Basil P. Mann,** Illinois Institute of Technology; **Lawrence C. Mohr,** Illinois Tech; **Jack Oita,** University of Nebraska; **William F. Pansing,** University of Cincinnati; **Eugene E. Richardson,** Kansas State; **Alvin W. Ries,** Cornell University; **Betty Ellen Ries,** Cornell; **Bruce A. Ritzenthaler,** Illinois Tech; **Paul N. Rylander,** Indiana University and Harvard; **John Sanik, Jr.,** Kansas State; **Walter D. Schmidt,** Johns-Hopkins University; **Robert D. Sieron,** Notre Dame; **Dean R. Smith, Jr.,** and **John P. Soderberg,** University of Michigan; **Edward A. Swakon,** Carnegie Institute of Technology; **Robert H. Wise,** University of Missouri; and **Samuel Young, Jr.,** University of Michigan, recently associated with Cities Service Oil Co.

D. R. McConnohie, formerly head of the cracking department at Cities Service Oil Co.'s East Chicago, Ind., refinery, has been transferred to Bartlesville, Okla., and promoted to engineer.

A. B. Bullock, of Shell Development Co., Emeryville, Calif., is studying recent developments in the field of microchemical analysis at New York University. He will return to the Shell laboratory early in 1952 and will be in charge of microanalytical work. A graduate of the University of California, he has been with Shell for 15 years.

Robert H. Perry, formerly independent operator at Fort Worth, Tex., has established offices at Evansville, Ind.

A. C. SAILSTAD

A. C. Sailstad, formerly president of Stanolind Oil Purchasing Co., and **S. A. Montgomery,** assistant general manager of the manufacturing department, for Standard Oil Co. (Ind.), have been elected to the board of directors of Standard. Sailstad has also been appointed general manager of the sales department to succeed **D. F. Benton** who was recently promoted to vice president in charge of sales. Montgomery continues in his present position as a manufacturing executive. Sailstad joined Standard in 1924 and was made president of Standard's subsidiary, Stanolind Oil Purchasing, in 1948. Montgomery, who has been with Standard since 1919, was named assistant general manager of manufacturing in 1946.

James A. Hall, assistant chief engineer in the Oil and Gas Division of the Texas Railroad Commission, has been transferred to the gas department.

DEATHS

Ralph V. Hanrahan, 66, retired president of Humble Pipe Line Co., died October 11 at Houston. A native of New York, Hanrahan spent 49 years in the pipe-line business, joining Humble in 1919 as general superintendent of the newly organized firm. He became a member of the board of directors in 1920, and was named vice president and general manager the same year. He retired in October 1950.

M. C. Hale, 43, manager of personnel and industrial relations for Shell Oil Co.'s Deer Park, Tex., refinery, died October 10 in Los Angeles.

Arthur Brewer, 64, former Ponca City, Okla., oil man, died October 12 at Hot Springs, Ark. While living in Ponca City, he operated Lewis Oil & Gas Co. and was part owner of Arthur Brewer Co.

Thorwald Jensen, 65, former marine superintendent for Cities Service Oil Co., died October 7 in Fanwood, N. J. He had been with the firm 30 years before retiring in 1946.

Arthur B. Morrison, chemist for many years in the research laboratories of The Texas Co., died October 7 in Beacon, N. Y.

Paul M. Isbill, 56, assistant general manager of domestic sales for The Texas Co., died October 10 in New York. He had been with the firm since shortly after World War I.

Frederick J. Beck, who retired July 1 after 37 years with Esso Standard Oil Co., died October 10 in Cranford, N. J. Beck had been a department head in the company's New Jersey sales division.

Frederick Monroe Goddard, 54, long-time accountant with Amerada Petroleum Corp., died October 12 at Clearwater, Fla.

Edgar B. Davis, 78, former Texas oil man, died October 15 at Galveston, Tex.

Reservoir Analysis of Redwater Pool

Complete Step-by-Step Procedure

PART 1

Geology · Structure · Core Analyses · Neutron Logs · Reservoir Oils

by Irene Haskett

REDWATER, discovered in October 1948, is now the largest known Devonian pool in Canada, with a recoverable reserve estimated at approximately 500 million barrels.

Redwater field is in North-Central Alberta, 35 miles northeast of the city of Edmonton. Drilling based on geophysical exploration led to the discovery of the pool by the Imperial Redwater No. 1 well, in LSD 4, 32-57-21w4. The well was completed by gun perforating the interval 3,131 to 3,218 ft., on October 12, 1948. The initial yield, after a total acid treatment of 19,000 gal., was 1,720 bbl.

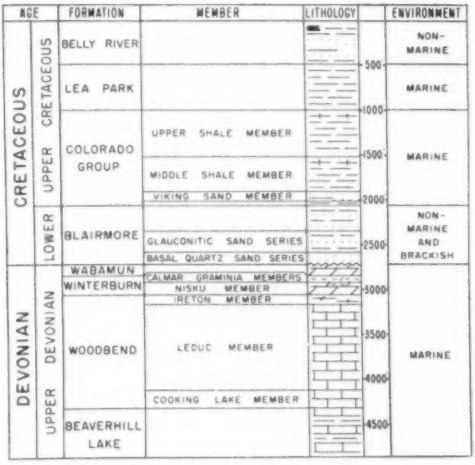


Fig. 1—Generalized stratigraphic column, Redwater field.

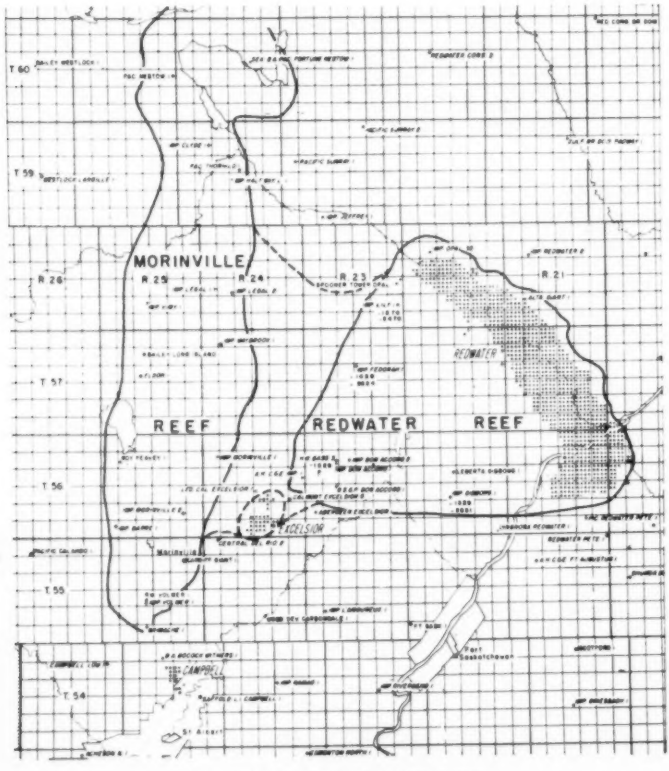


Fig. 2—Leduc (D-3) reefs, Redwater area.

per day of water-free 35° A.P.I. gravity oil, with a gas-oil ratio of approximately 190 cu. ft. per bbl.

Development proceeded rapidly on a 40-acre spacing pattern and, by the end of 1949, 296 successful producing wells had been drilled. In 1950, 457 producers were completed, making a total of 753 wells by the end of the year. This number was increased to 884 by August 1, 1951, with the completion of 131 additional wells in the first 7 months of the year.

Except in the southwest and northwest corners, dry holes have fairly well defined the productive area, and it is expected that full development of between 900 and 950 wells will be reached in 1952. With the exception of a few edge wells, initial potentials have been well over 1,000 bbl. per day after an acid treatment of usually from 1,000 to 5,000 gal. Practically all wells have been open-hole completions.

Regional Geology

The production in Redwater field is from the reefal Leduc (D-3) member of the Woodbend formation of Upper Devonian age. The reef is a coralline bioherm, about 900 ft. thick, with an areal extent of approximately 200,000 acres. Situated on the eastern flank of the Alberta syncline, it is affected by the regional dip to the southwest, and the productive zone occurs along the high northeastern rim.

Fig. 1 is a generalized stratigraphic column for this area. The overlying Ireton member consists chiefly of green shale, and acts as the main cap

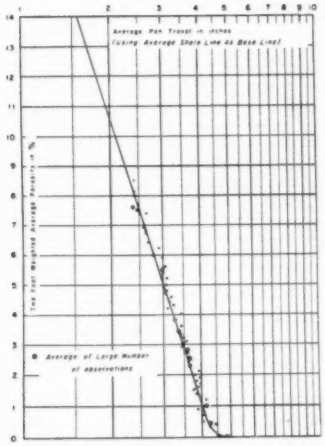

Average Pen Travel in Inches
(Using Average Shale Line As Base Line)
Two Foot Weighted Average Porosity in %
Average of Large Number of observations

Fig. 3—Correlation of neutron curve, pen travel vs. porosity, Redwater pool.

rock for the reef. The Cooking Lake member, also known as the fragmental limestone, is a blanket-type formation extending over a large part of the Alberta, and has a thickness of from 200 to 250 ft. In areas of reef development, this zone has porosity and permeability characteristics similar to those of the Leduc, and becomes practically indistinguishable from that member.

The probable areal extent of the Redwater reef is shown in Fig. 2. The south and northeast edges have been determined from seismic data, and additional control is provided by a number of dry holes. Along the northwest edge, however, geophysical indications are much less definite, and no wells have been drilled.

Several miles to the west is the Morinville reef, which is also built on the fragmental limestone to a thickness of about 900 ft. This reef is dolomitic, and is generally considered to be entirely separate from the Redwater reef. However, it is possible that a connection of either equal or reduced thickness is present in the intervening area. The Fedorah No. 1 well, in the Redwater reef, found about half limestone and half dolomite, making it appear that the differences in rock material in the two reefs might be the result of a gradual change from east to west. The Imperial Waybrook No. 1 well has been completed in the Morinville reef as a pressure observation well, and may eventually give some indication of the degree of continuity between the two reefs.

Reservoir Characteristics

A summary of basic data for the Redwater pool is given in Table 1.

Production of Redwater field is found at an average depth of 3,150 ft. The estimated productive area is about 37,000 acres, with the maxi-

THE AUTHOR

The author, with Imperial Oil, Ltd., Calgary, Alta., is probably the most outstanding woman technologist in petroleum - production - engineering work. Miss Haskett graduated from University of Oklahoma as a physics major, and started her career in the production research department of Carter Oil Co. at Tulsa in July 1944. While at Carter, she assisted in developing the electrical oil-pool analyzer, and in other research work on methods for reservoir studies. She went to Canada in 1949. Miss Haskett's paper was presented at 1951 meeting of Canadian Institute of Mining and Metallurgy (published in Institute's Transactions, Vol. LIV).

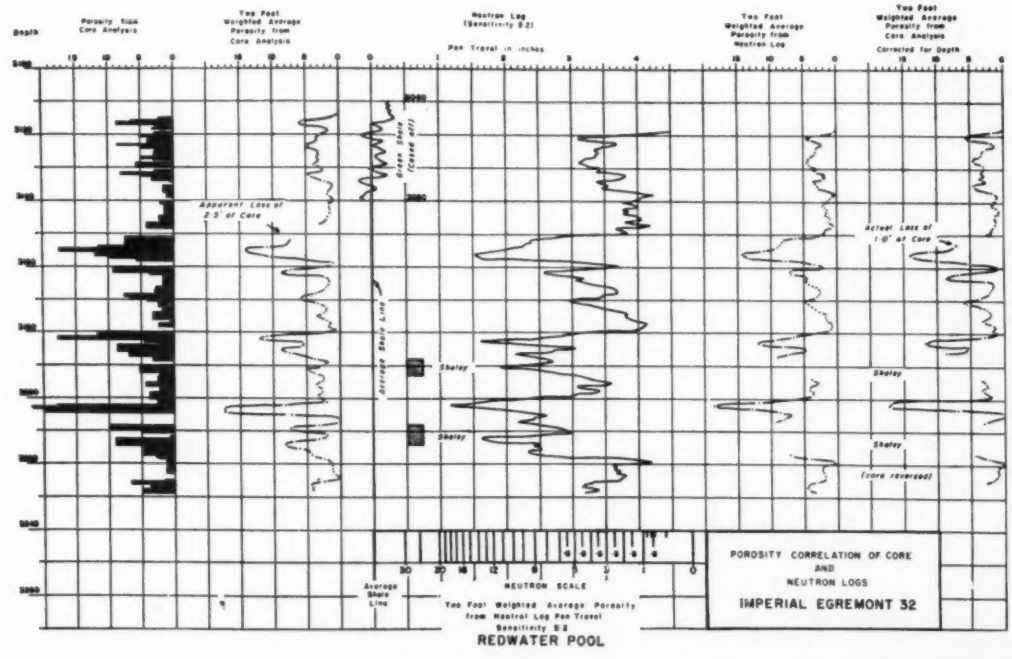

Depth
Porosity from Core Analysis
Two Foot Weighted Average Porosity from Core Analysis
Neutron Log (Sensitivity 2.2)
Pen Travel in Inches
Two Foot Weighted Average Porosity from Neutron Log
Two Foot Weighted Average Porosity from Core Analysis Corrected for Depth
Apparent Loss of 2.5' of Core
Green Shale (Cased off)
Average Shale Line
Actual Loss of 1.0' of Core
Shaley
Shaley
Shaley
Shaley
(Core reversed)
NEUTRON SCALE
Average Shale Line
Two Foot Weighted Average Porosity from Neutron Log Pen Travel Sensitivity 2.2
POROSITY CORRELATION OF CORE AND NEUTRON LOGS
IMPERIAL EGREMONT 32
REDWATER POOL

Fig. 4.

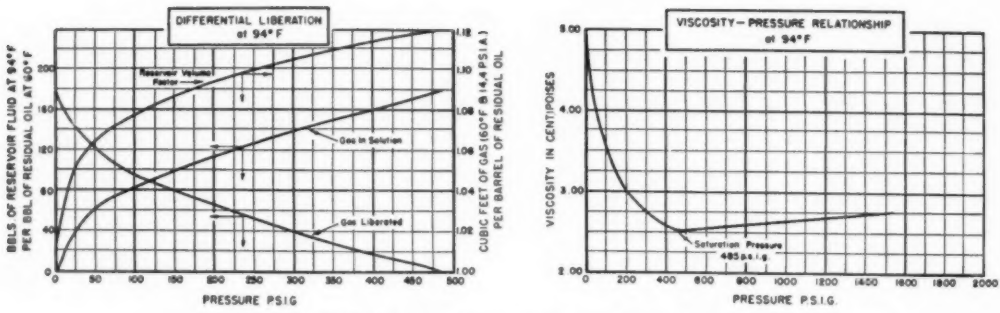

DIFFERENTIAL LIBERATION at 94°F
BBLS OF RESERVOIR FLUID AT 94°F PER BBL OF RESIDUAL OIL AT 60°F
CUBIC FEET OF GAS (60°F @ 14.4 PSIA) PER BARREL OF RESIDUAL OIL
Reservoir Volume Factor
Gas in Solution
Gas Liberated
PRESSURE PSIG
VISCOSITY—PRESSURE RELATIONSHIP at 94°F
VISCOSITY IN CENTIPOISES
Saturation Pressure 485 p.s.i.g.
PRESSURE P.S.I.G.

Fig. 5—Fluid characteristics of reservoir oil, Redwater pool.

mum thickness of the oil zone being slightly over 200 ft.

Over most of the pool area, a layer of nonporous, impermeable limestone is found at the top of the reef. All reservoir work has been based on the top of the porous section rather than on the top of the Leduc (D-3) formation.

In some parts of the field thin shale stringers are present, and dense limestone streaks having negligible porosity and permeability are scattered through the porous zone. Stylolites are common in both the dense and porous material.

Most of the void space in the reservoir is made up of the vugs, which exist throughout the productive zone, and the porosity of the sand-like intergranular material, which is found chiefly along the edges of the reef. A smaller amount of porosity exists in the dense matrix and in fractures.

Coring.—Diamond coring has been carried out on an extensive scale over the entire field. During the early stages of development, the minimum coring program was a pattern of about four wells per section and, in some cases, all wells on a lease were cored. More recently, neutron-gamma ray logs have been substituted for cores on a large number of wells.

The heterogeneity of the reservoir rock has necessitated considerable deviation from typical core analysis procedure. All measurements are made on large-size cores, as it was found that representative values were not obtained by the analysis of small plugs.

TABLE 1—BASIC DATA FOR REDWATER POOL

Est. productive area, acres	37,000
Water-oil contact, ft. subsea	1,236
Average oil zone thickness, ft.	93.6
Stock-tank oil in place, bbl.	1,242,600,000
Connate water (est.), per cent	15
Shrinkage factor	0.883
Average porosity, per cent	6.16
Original reservoir pressure, psig.	1,050
Saturation pressure, psig.	485
Reservoir temperature, °F.	94
Solution G.O.R.—Flash liberation, cu. ft./S.T. bbl.	215
Stock-tank oil gravity, °A.P.I.	35

At the time the samples to be tested are chosen, the footage for which each one is considered representative is also selected. In general, it has been found necessary to select and analyze an average of about one sample per foot of core to obtain good representation.

In one case, the average porosity obtained by weighting the results of measurements on such samples was checked against the average porosity value determined by analysis of the complete core. Practically identical values were obtained, indicating that the porosities determined with this method of sample selection can be considered quite accurate.

Porosity.—In evaluating core analyses, only material having either a vertical or horizontal permeability greater than 1.0 md. has been considered effective. Porosity in less-permeable sections is disregarded as probably containing a very high percentage of connate water, and as being essentially nonproductive. The porosities determined for the effective sections are weighted over the total footage cored, and the value obtained is assumed to be the average porosity of the entire oil zone. Since trends of increasing or decreasing porosity with depth are apparent in some portions of the field, more accurate values are obtained when a high percentage of the section is cored.

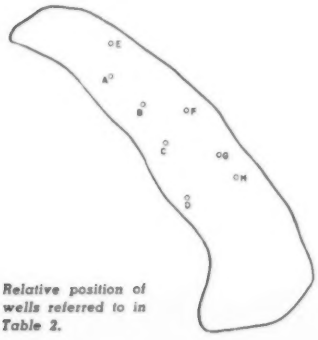
In addition to the wide variations in cores found in individual wells, there is a definite trend across the field in the average oil-zone porosity. On the west side, a large amount of interbedded dense material is present and the vuggy type of porosity, usually ranging from 4 to 10 per cent, is predominant in the effective portions. Toward the east, a much greater proportion of the zone is effective, and in some areas intergranular material, varying in porosity from 10 to over 20 per cent, predominates. The type of variations found, and the method of arriving at average porosity values, are shown for several wells on each side of the field in Table 2.

Neutron logs.—Using approximately the same methods as those recently described by McKay and Henley,[1] a correlation of porosity from core analysis and pen travel on neutron logs was made from 10 wells distributed over the pool. The results are shown in Fig. 3 and a detailed comparison of porosities obtained on the Imperial Egremont No. 32 well with the two methods is made in Fig. 4.

Average oil-zone porosity values obtained from both core analysis and neutron logs usually check within a fraction of a per cent. Shale streaks may be detected on the gamma-ray logs, and most of the other noneffective material may be eliminated by consideration of porosity values. In general, a porosity of from 0 to 2.5 per cent would be likely to have a permeability of less than 1.0 md.

Then an isoporosity map of the field was constructed. All available core analyses, neutron-gamma ray logs, and electric logs were used in constructing these contours. In gen-

(Continued on page 146)



Relative position of wells referred to in Table 2.

TABLE 2—TYPICAL CORE DATA, REDWATER POOL

Well—	A	B	C	D	E	F	G	H
Total oil-zone thickness (ft.)	89	126	55	59	91	130	97	98
Oil zone cored, (ft.)	71	112	37	41	84	106	92	96
Footage with permeability >1.0 md., (ft.)	37	63	27	22	64	96	84	98
Avg. porosity of effective footage, per cent	7.1	4.6	7.9	5.4	15.4	10.4	10.6	10.7
Avg. porosity of oil zone, per cent	3.7	2.6	5.8	2.9	11.7	9.4	9.7	10.7

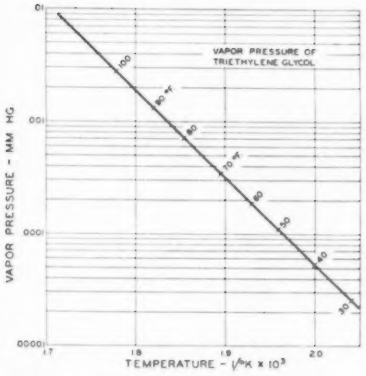


Fig. 1—Above: Vapor pressure of triethylene glycol, extrapolated from vapor-pressure curves at high temperature.

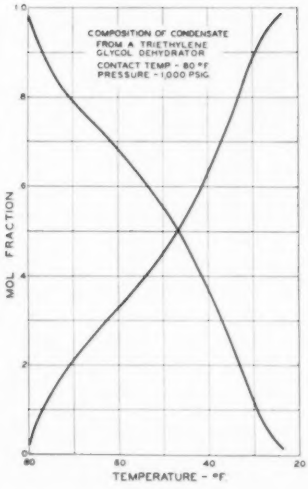


Fig. 2—Right: Composition of condensate obtained by cooling dehydrated gas.

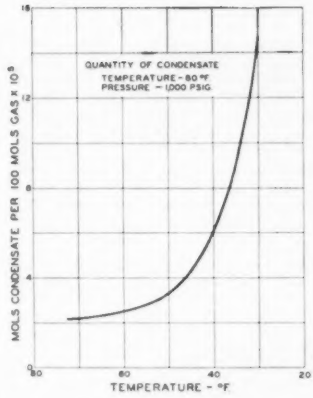


Fig. 3—Relative quantity of condensate obtained as dehydrated gas is cooled.

Measurement of Water-Vapor Content of Gases Dehydrated With Triethylene Glycol

by John M. Campbell* and Lawton L. Laurence†

DURING the last 2 years absorption equipment using triethylene glycol as a desiccant has become quite popular for the dehydration of natural gas. This new equipment has given specification dry gas with a 60 per cent saving in capital investment and at a substantial lowering of operating cost.

Triethylene glycol has several advantages over diethylene glycol as a desiccant, the two chief ones being the ease of reconcentration and the small losses encountered. The latter is the result not only of the lower vapor pressure but the unique mist extractor-heat exchanger section‡ in the top of the absorber which virtually eliminates entrainment.

One of the operating problems with any dehydration plant is the determination of the water content of the gas to evaluate plant performance. The chief means of doing this has been the Bureau of Mines dew-point tester which is applicable at temperature lower than 120° F. and pressures from atmospheric to 3,000 psi. When used with care this instrument has given satisfactory results where no third component was present in the gas, in sufficient quantities, to inhibit the visual determination of the dew point. However, Riesenfeld and Frazier[2] report that this instrument is in error when used on plants with diethylene glycol as a desiccant due to the glycol content of the condensate formed on the mirror. This results in the water-vapor content of the gas being less than that shown by the standard dew point-water vapor content correlation.

The water concentrations obtained by titration were multiplied by the glycol flow rate to determine the amount of water picked up as shown by this balance. The amount of water removed as determined by the dew-point tester was read from the water content chart of McCarthy et al.[3]

Results

Results of this investigation are given in Table 1. The per cent deviation shows the relationship between the results, the glycol balance having been chosen arbitrarily as the standard for comparison. With the exception of three readings the deviation was about 10 per cent or less and the net deviation, the sum of all the plus and minus figures, was only —2.6 per cent. These percentage figures may also be expressed in terms of dew-point error.

Exit dew points of the units tested varied from —5° to 20° F. If the latter figure is used the error in the dew point varied from 0° F. to an extreme of 3.8° F. A representative average of all points would show not over a 2° F. difference. Therefore, with the average triethylene glycol dehydrator, of the type tested, not over a 2° F. error should be encountered with a Bureau of Mines dew-point tester. These data confirm the laboratory data previously cited.

These deviations are even less significant from the standpoint of tester accuracy when the outside inherent errors are recognized. The largest of these is present in making a water balance around the glycol streams. The amount of the water removed was obtained by the subtraction of two numbers very large in relation to the difference. Even though the numbers were accurate to within 0.1 per cent the difference had a potential error statistically of 10 per cent. For example, consider the following analysis:

Lean glycol—0.9 lb. water per 100 lb. glycol.

Rich glycol—2.9 lb. water per 100 lb. glycol.

The actual difference is 2.0 lb. water per 100 lb. glycol. However, if the one figure is 0.10 lb. low and the other is correspondingly high, the difference would be 2.2, or an error of 10 per cent. When the magnitude of this experimental error is considered, it reduces even further

*Technical assistant to sales manager, oil and gas equipment division, and †chief engineer, Black, Sivalls & Bryson, Inc.

‡Patent pending.

the deviation which may be attributed to the dew-point tester.

Equilibrium Relationships

Composition of the gas leaving the top tray of an absorber may be obtained from published data on glycol losses[6] and a knowledge of the exit-water content. This water content may be estimated from the contact temperature since a 60°-80° F. depression is normally encountered.

No comprehensive equilibrium data on the triethylene glycol water-natural gas system are available at the usual exit dew point, at high pressure, so a quantitative analysis of the system in this range is impossible. However, partial pressures may be used to give at least a semiquantitative treatment. For example, the gas leaving an absorber at 1,000 psig. and 80° F. would probably have the following analysis:

Basis: 1,000,000 s.c.f. at 14.7 psia. and 60° F.	
Natural gas, lb.	45,900
Water, lb.	3.5
Glycol, lb.	0.067

Based on the vapor pressures shown in Fig. 1 part of the glycol present will condense in the line at 80° F. since the gas contains more glycol than could be held at equilibrium, as a result of some entrainment. In subsequent calculations it will be assumed that this glycol is present in the dew-point tester along with that which condenses on cooling.

Fig. 2 shows the variation in composition of the liquid on the dew-point-tester mirror at various temperatures, based on the above analysis.

This difficulty, however, had never been found with triethylene glycol systems in miscellaneous field tests by the authors, so a comprehensive series of field tests were undertaken to verify these results. About this time a paper was presented by Politziner, Townsend, and Reid[7] which gave the results of laboratory tests made on the triethylene glycol water-natural gas system.

The water content found by using a dew-point tester in conjunction with a water-content chart[1] was compared with that obtained gravimetrically. The difference between the calculated and observed dew points varied from 0° to 2.5° F. with an average of 1.79° F. These differences were both plus and minus and varied within the range of normal experimental error for the system involved. No visual glycol condensation or "fogging" occurred at any time which was further indication that triethylene glycol had no visible effect.

Experimental Procedure

Data were taken on a number of triethylene glycol units in the Gulf Coast area processing from 2 to 32 M.M.c.f. at pressures from 300 to 1,000 psi. At each unit the following data were obtained:

TABLE 1
Comparison of Dew-Point Depression as Measured by a Bureau of Mines Dew-Point Tester and Material-Balance Calculations on the Glycol Stream

Water removed per hour dew-point tester	Glycol balance	Per cent deviation of dew-point tester
3.37	3.51	—4.00
3.56	3.63	—1.38
2.51	2.59	—3.09
3.60	3.60	0
2.88	2.67	+7.87
2.54	2.68	—5.22
2.85	2.37	+18.9
2.54	2.93	—13.3
1.81	1.92	—5.73
2.86	3.20	—10.6
1.92	1.98	—3.03
1.49	1.41	+5.67
1.71	1.69	+1.18
2.81	2.46	+12.4
18.6	20.7	—10.1
3.84	3.82	—0.52
19.5	18.0	+8.33

Net deviation = —2.6 per cent.

1. Gas flow rate, temperature, and pressure.
2. Inlet and outlet dew points on the gas at the absorber.
3. Water concentration in the lean and rich glycol streams.
4. Glycol circulation rate.

Water concentration in the glycol was obtained by sampling at the unit, these samples then being analyzed by titration in the laboratory with Karl Fischer reagent. A potentiometric titrator was used to determine the end points. This particular method eliminated the human error in determining colorimetric end points which are difficult, if not impossible, to see in the glycol solution. Individual readings were reproduced with 0.1 per cent.

The curves shown are based on the gas contacted by a liquid analyzing 99 per cent triethylene glycol (TEG) and 1 per cent water by weight, which is a typical analysis. They show a very rapid change in the composition of the condensate as the temperature is lowered. The temperature at which the condensate becomes virtually all water varies with the degree of water absorption. In this example the gas has a water content equivalent to a water dew point of 15° F. Fig. 2 shows that at this temperature the condensate is virtually all water. For a gas with a higher equivalent water dew point the curves shown would be displaced to the left accordingly.

The word equivalent is used in reference to dew points for the true dew point of the glycol-water system is approximately at the absorber contact temperature, when substantially pure glycol starts condensing. This particular point, however, is of no value in the determination of the water content. Due to the inhibiting action of the glycol apparently, the spot on the mirror does not occur, at least in stable form, until the condensate is substantially all water. This point occurs at about the same temperature as when no glycol is present due to its low vapor pressure and the very small quantity present. The use of the word dew point alone is a misnomer and should be qualified as an equivalent water dew point.

Fig. 3 shows the relative amount of condensate to be expected as temperature is reduced on the representative gas. The steep slope below 40° F. is caused by water starting to condense in appreciable quantities and the large water to TEG ratio. This curve simply verifies the results shown in Fig. 2.

Summary

1. The Bureau of Mines dew-point tester gives satisfactory results for the routine determination of natural gas-water content in systems employing triethylene glycol as a desiccant. This is contingent upon the glycol entrainment losses being negligible.

2. Experimental agreement obtained in this work may be checked by a consideration of the equilibrium system due to the small amount of glycol present, and its low vapor pressure, which is about one-tenth of diethylene glycol in the normal plant operating temperature range.

3. Use of high concentrations of triethylene glycol reduces the glycol loss[6] which in turn gives more reproducible dew points.

4. Close check between the experimental and calculated dew points further substantiates the accuracy of the dew-point chart of McCarthy et al.[3]

5. The prime error in the use of this tester is a human one. On the basis of a large number of observations the authors feel that these are due to:

(a) The reduction of the mirror temperature too rapidly.

(b) The use of a mirror which is not brightly polished. It should be polished regularly and occasionally buffed with jeweler's rouge or the equivalent.

(c) Inability to distinguish between a water spot and the unstable spot caused by hydrocarbons.

(d) The presence of an excessive amount of hydrocarbons which flood the mirror. This difficulty may be corrected by the use of a small oil scrubber between the line and the dew-point tester.

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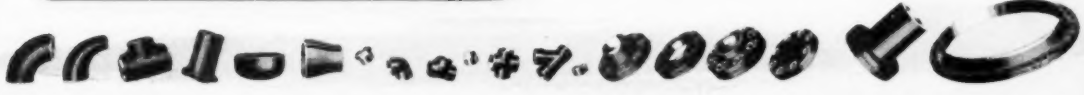

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The Interstate Oil Compact Commission Reports on

WELL SPACING

Report by Compact's Research and Coordinating Committee, G. E. Eddy, Chairman (Director, Michigan Conservation Department), at meeting in Forth Worth, September 1951.

Conclusions of Committee

BASED on the restudy that has been given to the spacing problem, including the observations based on the experiences of committee members the following conclusions are arrived at:

Reservoir continuity.—While porosity and permeability of oil reservoir rocks are usually more or less irregular and apparently lacking in even continuity, either horizontally or vertically, experience shows that in either sand or limestone reservoirs there is usually sufficient continuity to permit flow and production performance to some extent the same as they would be if continuity were complete. Exceptions would be reservoirs where discontinuities have the effect of dividing reservoirs into a multiplicity of productive segments.

Variations in oil and gas productive capacities of wells that are usual throughout fields, and among even closely offsetting wells, are evidence that discontinuities in porosity and permeability have marked local influences on movements of fluids. These localized influences are not necessarily field wide in effect.

Gas energy.—The potential expansion energy of the gas in solution in most oil reservoirs is very great. Theoretically it is many times that believed to be necessary to move oil horizontally through reservoirs from the borders of a 40-acre, or larger, tract to a centrally located well. Energy potential varies, of course, with solution gas-oil ratio and pressure.

A substantial proportion of the gas energy in a reservoir is expended in lifting oil from bottoms of wells to the surface. Total original potential is so large that the portion expendable for moving oil and overcoming frictional and other reservoir losses, before entry of oil into the well bores, is many times enough to move oil horizontally over long distances.

Water drive.—In water-drive reservoirs the energy available for moving oil from remote locations in a reservoir is limited or inherently qualified primarily by time. The efficiency with which this energy may be expended is dependent upon type of porosity, percentage of porosity, permeability, and structural relief and conformation, but not on well spacing.

Combined gas and water energy.—For reservoirs with combination solution-gas and water-drive energy, maximum practicable efficiency can be obtained by so controlling well and total production rates that oil in moving toward well bores may retain its gas at as nearly original solution volume as possible. This control should provide for expenditure of water drive energy only until oil reaches the vicinities of well bores, and should permit the use of gas energy mostly for lifting oil from the bottoms of wells to the surface. An important subsidiary consideration would be production of an even volume of gas over a maximum space of time for beneficial surface uses, or return to reservoirs.

Gas-cap drive; gravity drainage.—In either gas drive or combination gas and water-drive reservoirs where water drive is very slow the driving influences of either gas-cap or gravity drainage are important as oil-recovery agencies. Either or both should be accorded considerable credit as recovery mechanisms.

Gas expansion, one well to 40 acres. In strictly gas-expansion drive reservoirs of very low permeability, volume of ultimate recovery of oil is not inherently dependent, except to a very minor extent, on well density, within the range of one well or more to a square 40-acre tract of land. The 40-acre figure is to some extent arbitrary. A qualification is that where there is a lack of either vertical or horizontal permeability and a pool may be divided into several producing segments, each segment, large or small must have production outlet through at least one well.

Water drive, wider spacing.—In water-drive or combination gas and water-drive reservoirs, within normal ranges of porosity and permeability, the volume of ultimate recovery of oil is not dependent on well density. Wider spacing than normally used may be sufficient, depending on structural, reservoir, and fluid characteristics.

Sands vs. limestones.—The basic considerations in movement of fluid in oil reservoirs are applicable to either sandstone or limestone—dolomite reservoirs.

Well spacing vs. depletion time.—Well density can have a very important effect on the time required to produce all of the recoverable oil in a reservoir or a producing segment of a reservoir. The greater the well density the less should be the number of years required, provided marked demand is high, to produce the maximum of recoverable oil from a pool.

Production control.—Efficient production methods, including maximum obtainable control of energy, with resulting efficient use of this energy in moving oil, is most important factor that is subject to control by operators in securing maximum ultimate production of oil from a reservoir or a separate producing segment of a reservoir.

(a) **Water drive; uniform advance.** In fields with reasonably active water drive the primary aim should be to so control production from individual wells and from the reservoirs as a whole that edge and bottom water advances will be reasonably regular, or approaching a level plane. This prevents or minimizes coning or premature advances of water into areas of high permeability.

(b) **Gas expansion; minimum GOR's.** In fields where water-drive is absent, or of only minor importance, and solution gas is the only active driving agency the problem becomes complex. To move the oil some gas must escape from solution and continue expanding as free globules. This escape from solution should be kept at the lowest practicable rate.

It is possible that the problem may be best solved by restricting oil production from individual wells to rates that will result in lowest producing gas-oil ratios. This production rate can be determined only by testing individual wells.

The most efficient control would include both individual well and field-wide regulation. Strict physical conservation would be apt to require that gas-cap wells and some high gas-oil wells be closed in entirely.

Fit well locations to pool conditions.—If the aim in reservoir control be that of securing the greatest ultimate recovery of oil from the reservoir as a whole the question of location of wells ceases to be that of

density, or spacing on some geometrical pattern. Rather, well locations will be chosen to fit structural and reservoir characteristics or peculiarities, including the many possible variations in different sections of the same pool.

(a) **Outlet for each segment.**—Each producing segment of a reservoir must have at least one well outlet.

(b) **Save gas caps.**—A gas-cap area should not be evacuated, and such an area needs no oil-well outlet.

(c) **Water drive: updip locations.**—If a reservoir has an active water drive, either edge or bottom, and even if there is solution gas in substantial amounts, it might be that all well outlets should be updip from the oil-water contacts, possibly at points of high structural elevation if there is no gas cap.

(d) **Gravity drainage: downdip locations.**—Inasmuch as energy influences of gas-cap drive or gravity drainage are downward, wells at lower structural locations would be advantageous if and when these oil expulsion influences are operative.

Factors influencing recovery. — In summation, the volume of recovery from an oil reservoir is normally less dependent on well density than on other factors. Some of these factors are reservoir rock, fluid and its performance characteristics, and well-completion, production, and conservation practices.

Some of the variable characteristics favorable to high per acre-foot recoveries are (1) high porosity, (2) uniform porosity, (3) high relative permeability, (4) low gas-oil fluid viscosity, (5) low connate water, (6) low percentage of reservoir oil shrinkage, (7) effective driving energy, and (8) high productive index factors.

The variables to which operative control should be directed are high degree of pressure maintenance, gas-oil ratio and gas-cap control in gas-drive reservoirs, and return of produced gas and water to reservoirs to conserve drive energy.

The opposite characteristics in the above variables usually suggest low per acre-foot recoveries.

Driving energy in moving oil to wells requires special elaboration:

Active water drive is more efficient than gas in moving oil in reservoirs. Very active water drive presupposes high porosity and permeability in the aquafer supplying the water drive.

Edge-water drive rather than bottom water is usually desirable.

Gas drive is of great importance, but is not as efficient as water in moving oil to wells.

A combination gas and active water drive with oil saturated, or possibly undersaturated, with gas at initial reservoir pressure furnishes highly efficient drive mechanism when properly controlled.

Careful well completion and adequate remedial measures when necessary are considerations that should not need emphasis. Such phases of conservation as may be subject to control by state regulatory authority have an important influence on reservoir recoveries.

Closer Well-Spacing Patterns Are Suggested in Cases of:

1. **Narrow structure.**—When an irregular or very narrow structure is being developed and wide spacing results in a high percentage of dry holes without showing trend of field or providing adequate drainage for reservoir.

2. **Quick depletion.**—When it is desirable to shorten the producing life of a reservoir by drilling additional wells and sacrificing recovery of oil per well for time gained.

3. **Channeling and coning.**—In fields with strong water drives and irregular permeability the inherent danger of channeling and coning of water at high daily per well allowable rates frequently controls optimum per well allowables. The drilling of additional wells would permit increase of producing capacity of a reservoir without increasing per well production, and without appreciably increasing tendency toward channeling or coning of water and danger of trapping oil. The closer spacing might not appreciably increase ultimate oil recovery from a reservoir.

4. **Low permeability.**—In low permeability pays with dissolved gas drive and sufficient pay thickness to warrant drilling of additional wells to adequately and efficiently drain the reservoir, close spacing may increase ultimate recovery in many instances but in borderline cases would not bring sufficient return to warrant expense of additional wells.

5. **Gas-cap conditions.**—In fields with gas-cap or gas-injection projects, where higher concentration of wells outside gas-cap areas may be desirable for greater efficiency in operations.

Wider Well-Spacing Patterns Are Suggested in Cases of:

1. **Much closure, large wells.**—When reservoirs have considerable structural relief and high porosity and effective permeability, resulting in high productive indexes, which in turn permit high individual well allowables with low producing bottom-hole-pressure drawdown.

2. **Medium conditions.**—Where reservoir studies indicate limited water drives and low optimum reservoir withdrawal rate, wide spacing should permit economically satisfactory per well allowable and still result in reasonable pressure balance for the reservoir.

3. **Low recoveries.**—When thin pays indicate low ultimate reservoir recoveries, and close drilling is not economically justifiable.

4. **High costs.**—When deep pays result in high drilling and high operating costs per well, requiring a greater return per well to insure reasonable returns on investments.

5. **Injection operations.**—When recovery operations include expensive fluid injection programs it is necessary to hold drilling and well-operating expenses at reasonably low levels to insure satisfactory returns on overall investments. The maintenance of reservoir energy through fluid injection projects should permit relatively high individual well allowables, and give reasonable assurance of satisfactory ultimate field recovery.

6. **Low pool withdrawals.** — When reservoir studies show that low total reservoir withdrawals are desirable to maintain reservoir pressure. Reasonably high per well allowables might be justified, and a high percentage of the total oil might be recovered by flowing.

Modern Concepts of Reservoir Development

Unitization.—If the full aims of conservation are to be accomplished individual property or lease boundary lines will be disregarded in choosing well locations. Individual wells will become channels through which oil is expelled from whole reservoirs or producing segments rather than from separate properties. Some form of unitization of fields will be necessary, with pooling of all petroleum ownership, all driving energy, and all expenses of development and production.

Economics.—Attention so far has been confined to well density or spacing mostly as it refers to ultimate total recovery of oil from reservoirs. It is clear that considerations of expediency and of economics are vital elements in the well spacing or density problem, to the extent of being,

(Continued on page 108)

C. A. Hurst's WALKER-NEER SPUDDER, Model C-37—operating near Midland, Texas—drilled the plug at 7200 feet, hit pay at 7600 feet, ran the tubing and completed the well, in 12 DAYS—topping all previous records for similar jobs in the Spraberry Field!

"It's Caused Quite a Sensation Around Here!

"This," says Mr. Hurst, "is the smoothest running, fastest operating, most economical spudder I've seen—and the fastest to set up. We hoisted tools and bailer out of a 7600-foot hole in high gear (that's an average of 650 feet per minute for tools, 1250 feet per minute for bailer)—and the spooling, without any manual device, looked like it was done with a machine!

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VINYL RESIN COATINGS

by C. G. Munger*

Because of open-work design, continuous operation, and constant formation of corrosive fumes, the petroleum refinery requires special coatings for their high resistance to humidity, weather, and chemical attack. The tests reported here indicate that vinyl resin coatings can handle many of the refinery's lesser corrosion problems.

IN the last few years, the descriptive terms vinyl, vinyl coatings, and vinyl resins have been applied to a large number of coatings and products without a real definition for these products. Theoretically, a vinyl resin is any material composed of a basic vinyl molecule, which is a carbon-double-bond-carbon group. Any number of side groups may be applied to this basic molecule and under proper conditions polymerization will take place and a resin will be formed.

It is not necessary to have a pure monomeric product in order to form a resin but other vinyl monomers or other products containing the carbon-double-bond-carbon group may be included so that copolymers may be formed as well. Assuming these variations, it can be seen that there are hundreds of different combinations of molecules possible which would result in just as many different kinds of resins, all of which could be classified as vinyls.

Some of the more common monomers used for polymerization alone or copolymerization with two or more monomers are vinyl chloride, vinyl acetate, vinylidene chloride, acrylate and methacrylates, allyl compounds, acrylonitrile, butadiene, stryene, and vinyl butyral.

Out of all these possible combinations there are a few materials which are outstanding as far as coating formation is concerned.

The Vinylite resins as manufactured by Bakelite Corp., are copolymers of vinyl chloride and vinyl acetate. There are a number of Vinylite resins available which range in molecular weight from 5,000 to 50,000 and which have a vinyl chloride, vinyl acetate ratio or from 85 to 15 to 95 to 5. The low and medium molecular-weight resins in this group are excellent film formers with good solubility in their own specific solvents. The film when laid down is extremely tough, abrasion resistant, and has a very wide range of chemical stability from concentrated acids to concentrated caustic solutions. Extreme oxidizing acids, such as concentrated sulfuric, will tend to carbonize these films.

Another series of vinyl resins are those trade named "Geon," by B. F. Goodrich Co. These resins are composed either of vinyl chloride alone or are copolymerized from vinyl chloride and vinylidene chloride. This series of resins also varies from low-molecular-weight materials to extremely high insoluble-type resins suitable only for sheeting or molding.

In resistance, Geon resins, in general, follow rather closely the vinyl chloride, vinyl acetate copolymers; they have good acid resistance, good alkali resistance, good resistance to salt solutions, and some of the resin formulations may be superior in resistance to moisture vapor transfer.

Composition

The Saran resins are also vinyl resins and these may be processed into coatings also. The Saran resins are manufactured by Dow Chemical Co., and are somewhat different from Geon and Vinylite in that they are composed of vinylidene ormcopolymerized with acrylonitrile.

The vinylidene chloride and acrylonitrile resins have a number of different properties from the two above. They have a low moisture vapor transfer rate and very low transfer of gases such as carbon dioxide, oxygen, etc. They are not as resistant to ammonia and alkali as the others outlined above and do not have quite the hydrocarbon resistance as the other materials. The solvent retention of Saran is high and when sprayed it tends to web. In general, however, their over-all chemical resistance is good.

There are also other important vinyl resin products such as poly vinyl butyral, poly vinyl formal and polystryrene, all of which are manufactured by the above or similar chemical companies.

It can be said that in general the resins which are used for vinyl coatings provide tough semielastomeric film which have a high resistance to acids, alkalis, and chemical solutions. In addition, they have excellent resistance to oxidizing conditions and to aging. Their resistance to petroleum hydrocarbons is excellent and for the most part they are unaffected by gasoline, diesel oil, lubricating oil, and crudes.

Properties

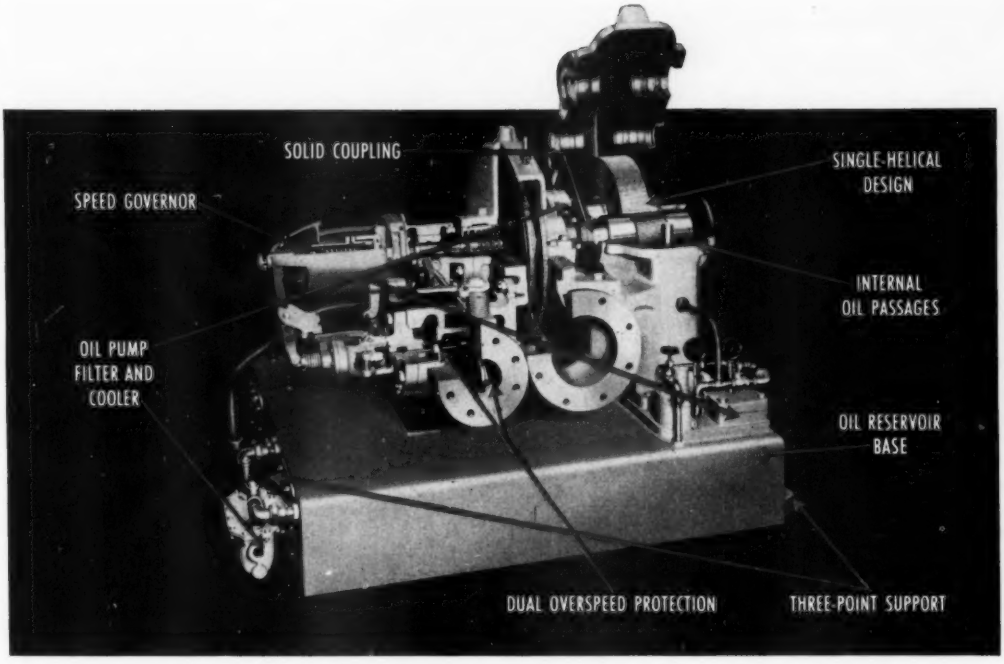
Vinyl films are noninflammable and will not support combustion by themselves. Excellent fire-resistant coatings can be made from them. They have a low water absorption and a low moisture vapor transmission rate. The major limitation of vinyl coatings in a refinery is their resistance to continued high temperature. Except where specially formulated, vinyl resin coatings are not satisfactory for temperatures above 180° F.

The number of vinyl resins available and their varying properties make it possible to formulate vinyl coatings with almost any properties. They can be made to have a high moisture vapor transfer or a low one. They can be alkali resistant or alkali reactive. One formulation of a vinyl coating can be used as an over print lacquer on a plastic sheet to protect numbering and letters while another vinyl coating may be designed for extreme chemical, weather, and water resistance. Such a coating might be for the exterior of tanks and adjacent piping in the vicinity of a cooling tower or somewhere on the lee side of an acid plant.

Both of the above coatings are vinyl resin coatings; however, it would certainly be foolish to use an overprint lacquer as a tank coating and vice versa. The point here is that the formulation of vinyl coatings is extremely important. That is especially true in refineries because of the varied and difficult conditions to which the coating is exposed.

Conditions under which the coating is to be used determine the formulation of the vinyl coating itself. For the exterior of equipment, tanks, structural steel, concrete surfaces, vinyl resin coatings have been for-

*Technical director, Amercoat Corp., South Gate, Calif. Presented at A.S.M.E. petroleum mechanical engineering conference, Tulsa, September, 1951.



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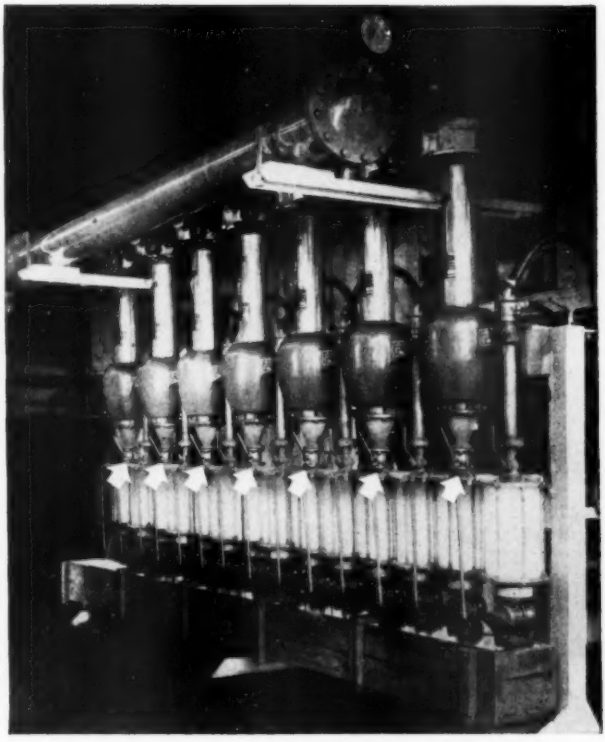

The Bird Machine Company of South Walpole, Mass. now equips all Dirtec units (right) with Rockwood Ball Valves to assure papermakers better and longer *trouble-free* valve service. These efficient Dirtec units have won their place in the dirt removal phase of operation in paper mills of all kinds and sizes on the basis of practical demonstrated performance. Rockwood is helping to keep this enviable performance record by producing a ball valve that will operate over and over again without requiring maintenance.

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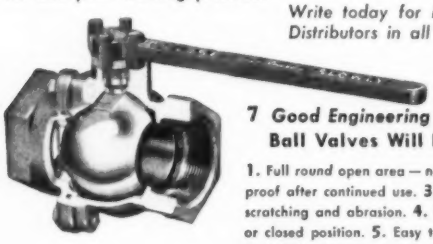

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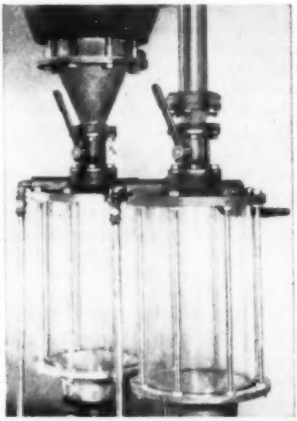
Picture below shows close-up of the latest design of Dirtec. Rockwood Valves isolate the body of the Dirtec from the sump in which the dirt collects. At bottom of sumps, a 2" Rockwood Valve is used for dumping the dirt.



ROCKWOOD SPRINKLER CO
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mulated as a single material which combine the properties of good adhesion with resistance to weather, fumes, splash and spray of acids, alkalis, or salts. These coatings are, for the most part, made from lower-molecular-weight vinyl resins which are more soluble, slightly softer, and more easily worked. While they have the same basic chemical resistance of all vinyl resins, their resistance is of a lesser degree.

One of the vinyl resins mentioned above was poly vinyl butyral. This is the resin from which has been formulated the metal surface conditioner known as "wash prime." This particular formulation has proved to have some excellent properties where surface preparation is difficult and except for severe chemical exposure or immersion, it provides a good base and surface treatment for the liquid-applied vinyl coatings.

Experience has shown that for most immersion conditions, tank linings, and similar exposures, the only way a vinyl coating can be effective full use made of the properties of the basic materials is to formulate them into a system coating. By a system coating is meant the use of a prime, intermediate, and seal coat. There are good reasons for formulating in this manner.

Purpose of Prime Coats

Prime coats are for one purpose only and that is to tie the following coats tightly to the underlying surface. The prime coat of necessity must be highly resistant or the coating would be built on a quicksand foundation. In addition, however, it must be penetrating, must have good wetting properties, must apply easily, and when dry it should provide a good base over which the other coats can and will strongly adhere.

Intermediate coats need have none of the prime properties as long as it is possible for them to be compatible and adhere to the prime coat. The main purpose of these coats is to build thickness, density, and by their thickness to level out the small hills and valleys in the surface over which they are applied. These coats must be highly resistant and have a low porosity.

Final coats of the system are ones which provide a seal over the entire surface and shall by their low pigmentation provide a very dense, almost pure vinyl resin film over the whole surface. This type of formulation has proved extremely effective in very severe chemical exposures which range from concentrated caustic soda to acidic copper sulfate solutions.

While the above system coatings have been subject to immersion in difficult conditions, it is possible to go even further with vinyl resins and to use the highest-molecular-weight type which are the toughest and most resistant to all chemical solutions. These resins, for the most part, are difficulty soluble and therefore can not be used as a liquid coating. They can, however, be formulated into sheets which may be applied to concrete or steel surfaces by adhesives or mechanically locked into concrete surfaces. These materials also, while having high molecular weight, still have the valuable property of being thermoplastic and when properly formulated may be heat welded to themselves. Under these conditions tanks or structures can be lined with a continuous plastic lining in which pin holes, holidays, and other failures of painting techniques are eliminated.

These linings also have appreciable thickness in that they range from .030 to ¼ in. in thickness. With such linings permanent coatings are obtained with even extremely difficult chemical solutions. Such linings have proved excellent for hydrochloric, sulfuric, and phosphoric acid tanks and for cencentrated acid salts such as copper chloride, copper sulfate, ferric chloride, etc.

Vinyl resin coatings of any type have one basic requirement. This is that they be properly applied over perfectly clean, dry metal or concrete surface. Many coating failures are caused by improper applications and by poor surface preparation. The life

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of any coating can be improved and multiplied several times if there is care in application and if the surface over which material is applied is clean and dry. The reason these conditions are exaggerated with vinyl coatings is that vinyl coatings are ordinarily used where other materials fail.

Inasmuch as the conditions under which vinyl coatings must stand up are continuous exposure to acid or alkali fumes, actual immersion in acid solutions, or continuous contact with a corrosive gas, it can be readily understood that the surface preparation and application of these materials must be of the highest type. This point is believed to be demonstrated when it is taken into consideration that a vinyl coating is relatively thin, for the most part being only a few thousands of an inch in thickness and that this film separates two highly reactive materials. These are oxygen, acids, or alkalis on the exterior of the film and iron or concrete underneath the film. Under these conditions if the film is not continuous then an immediate reaction can take place between these two reactive products.

Because vinyl resin coatings are only used where difficult corrosion exists, application cannot be overstressed and yet it must be pointed out here that there is nothing actually difficult in the application of vinyl coatings. They are ordinarily applied by standard paint equipment. They may be brushed or sprayed without difficulty and care is really the only major requirement which varies from that of conventional paint.

Surface Preparation

Surface preparation is naturally first and a thoroughly clean, dry metal surface is required for the application of vinyl coatings under refinery conditions. The best type of surface preparation for vinyl coatings is a sandblasted surface. By sandblasting, the steel surface is thoroughly cleaned down to gray metal. The surface is not only cleaned but it is broken up so that the actual surface area of the steel is multiplied several times which provides mechanical bond and tooth for the coating. Sandblasting is advantageous inasmuch as it can be used on existing structures and the equipment used for blasting is portable.

The second method of surface preparation is that of acid pickling. This is second best. By acid pickling, all mill scale, rust, and corrosion products are removed from the surface of the steel and a thoroughly clean steel surface can be obtained. Acid pickling provides some tooth for the coatings. However, it does not provide the same degree of tooth as sandblasting. Acid pickling is ordinarily restricted to new work, inasmuch as pickling of existing structure is impossible.

The third method is by the use of power sanders. This equipment is portable. It removes the majority of all rust, mill scale, and corrosion products. It does not, however, remove them entirely. It is very definitely a third best method.

The fourth method is by chipping and wire brushing. It is felt that this is the least desirable method of surface preparation in that only the heavy corrosion scale and corrosive products are removed. It is better than no surface preparation at all but at the same time it does allow for continued underfilm corrosion because of corrosion products left on the surface.

Underfilm corrosion is particularly important in refinery operation as hydrogen sulfide and sulfide corrosion are very common due to the increased use of sour crudes. Should steel surfaces which have been exposed to sulfide corrosion be coated, and the surfaces are not thoroughly clean, the following reaction will take place. Hydrogen sulfide or other sulfides will react with the iron to form iron sulfide. This, in turn, is reacted upon by moisture from the moisture vapor transfer through the coating to form iron hydroxide and regenerate hydrogen sulfide. The result is a continuing underfilm corrosion with the resultant blistering and film dis-

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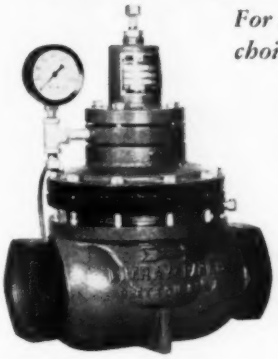

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ruption. This particular reaction has been demonstrated many times where sulfide corrosion is a particular hazard. It is particularly graphic when an old tank has been cleaned and has been repaired with a new plate.

When the interior is sandblasted it will be found that the old plate in tank will turn dark very quickly even though blasted to gray metal initially while new plates will remain an even light gray for a much longer time. In this case it is the sulfide which remains in the surface pores of the metal which oxidizes on exposure to air. When coated it has been found that the old plates will fail much more rapidly than the new because of underfilm corrosion. It can be readily seen, therefore, that if a coating is applied over steel surfaces containing iron sulfide the life of any coating, including vinyl, would be limited.

While on the subject of sulfide corrosion and surface preparation, the procedure suggested for overcoming any remaining sulfide on the surface is to thoroughly blast or power sand surface then thoroughly oxidize the surface by either flame treatment or washing with water and allowing to rust. The heat treatment is preferred. Following the oxidization, reclean the surface by sandblasting, preferably, or power wire brush. Remove all of the oxidized sulfides which were on the surface. Steel surfaces treated in this manner should be equal to new steel when coated.

Second to proper surface preparation in the life of a coating is its adhesion. Without proper adhesion, coatings will tend to fail by early blistering or underfilm corrosion due to moisture vapor passing through the coating into the areas of poor adhesion. Adhesion of vinyl coatings is dependent upon proper surface preparation. This is due to the vinyl resins themselves having nonpolar structures and a high molecular weight so that wetting of the surface is difficult. Surface preparation, therefore, is not only important to provide a thoroughly clean surface, but one which will aid the adhesion of vinyls by providing a mechanical bond as well as a chemical one.

Dust or moisture on the surface of the steel during the application of vinyl coatings will materially retard adhesion and in order to protect against minute quantities of either of these it is recommended under all conditions that the vinyl coating primer be brushed into the metal surface in order to help the coating thoroughly wet the steel by mechanical means.

Coating thickness is important in any coating. However, as with adhesion, it is of major importance in vinyl coatings. The reason for this is the relatively low solid content of vinyl solutions because of their high molecular weight and tendency to become gel like in structure where high concentrations of resin are put into solution. While many paint coatings have a total nonvolatile of 50 to 75 per cent or even more, as in the case of linseed oil paints, vinyl coatings have a total nonvolatile in the neighborhood of 25-30 per cent. It can be seen, therefore, that it is important to maintain an even coating of uniform thickness wherever severe chemical corrosion is found.

Resistance of a coating to moisture vapor transfer is directly proportional to the coating thickness and this is one of the reasons why pin holes and thin spots in the coating tend to fail first. Rough areas in the steel, rivets, bolts, edges, and corners are all areas where the thickness of a coating may be neglected. These rough and uneven areas when not coated with the same thickness of the coating as the smooth areas, become focal points for corrosion.

Coating Continuity

Just previously it has been mentioned that coating thickness is an important point. Continuity of the coating means that this thickness should be maintained evenly throughout the entire coating application and that pin holes, holidays, and thin spots in the coating must be kept to a minimum if proper results are to

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be obtained under severe corrosion. In all of the above, we have assumed that the corrosion was severe and that the best possible coating and coating procedure is required to protect the underlying metal.

The degree of the corrosion determines almost entirely the amount of surface preparation and care needed during coating application. It also determines the need for the coating itself. In other words, if ordinary atmospheric exposure is the problem, then neither vinyl coatings nor the care in surface preparation and application is required. If, however, the interior of the tank is to be coated to protect against sulfide corrosion, then all of the above points should be watched very carefully and a vinyl coating is indicated in order to withstand the severe conditions. A vinyl coating, because of its resistance, when properly applied with the proper thickness and properly formulated will outlast conventional paint several times even under moderately severe corrosive conditions.

There are innumerable examples of refinery equipment which have been more effectively protected by vinyl coatings than with any othr method of coating protection. Some examples of these are:

Exterior of caustic tanks.

Sulfur dioxide blowdown tanks.

Acid plant areas subject to sulfur dioxide fumes.

Salt-water vertical-tube ammonia coolers.

Exterior of gasoline treaters subject to continual condensation.

Interior of lead-lined gasoline treaters.

Interior of certain type treaters.

Gas area on interior of floating-roof tanks subject to sour crude and raw gasoline.

Interior of pan tanks subject to sour crude and raw gasoline.

Tank exposures subject to general refinery fumes, high humidity, salt.

Marine installations such as steel wharfs and above-salt-water pipe lines.

Interior of acid sludge tanks.

Interior of pipe lines subject to treating liquids.

Interior of concrete pipe for refinery sewers.

It is felt that this is an impressive list of areas which are subject to severe corrosion in refineries. It is believed also that these uses demonstrate the versatility and wide resistance of vinyl resin coatings. An example is the exterior coating for caustic tanks. The coating is subject to caustic spillage and overflow from the top of the tank. When this happens 50 per cent caustic soda may remain on the exterior of the coating for an hour to several days, before it is washed down.

Because of the very high alkali resistance of the vinyl resin coatings it is possible for these coatings to withstand not only the atmospheric weathering to which these tanks are

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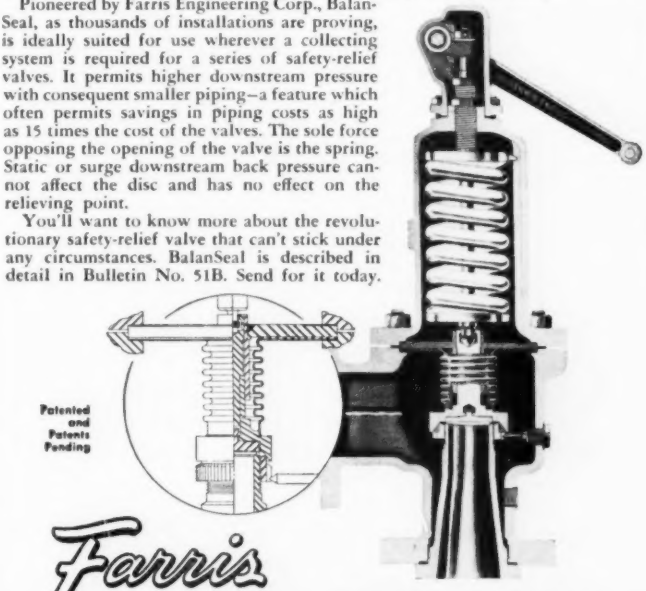

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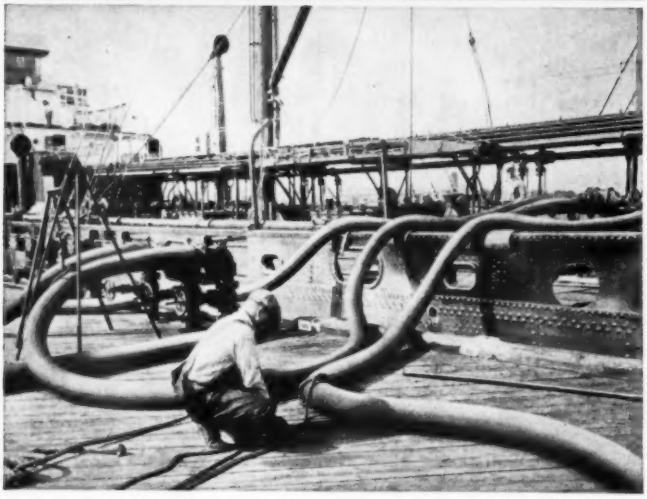

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And faster flow is only one "plus" of this original Hewitt-Robins development. The specially-compounded tube can't pull loose; it's bonded to the tough duck carcass. No leakage either, because nipple and hose are cured together for perfect adhesion.

Oil Suction and Discharge Hose is but one of many Hewitt-Robins hoses specially engineered for the oil industry. For complete information, call your Hewitt Rubber distributor (see classified phone book—"Rubber Products" listing), or write Hewitt Rubber Division, 240 Kensington Avenue, Buffalo 5, New York.

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subjected but also severe chemical treatment. A number of caustic tanks have been lined in various refineries. Previous coatings have had a life of only one overflow or one serious spill. Vinyl coatings have been unaffected for more than 2 years service under these conditions.

Another example and one which is even more severe is the interior of sulfur dioxide blowdown tanks. Here the condtions are gaseous sulfur dioxide, 20-50 per cent caustic soda; so that the coating in this case is not only subject to continuous exposure to caustic soda but must at the same time withstand sulfur dioxide fumes above the caustic soda liquid level. Vinyl coatings on panels were tested under these conditions for more than a year. They were unaffected during that time. The tank was then completely cleaned out, sandblasted, and a vinyl-coating system applied to the interior. This has been giving satisfactory service under these severe conditions for more than 2 years.

The above exposure examples have all been severe chemical exposures and they were picked to demonstrate the limits to which vinyl coatings may be used. It is believed that they not only demonstrate the resistance but tend to indicate that the lesser corrosion problems in refineries can be readily handled by these materials.

Well Spacing

(Continued from page 98)

together, the final governing influences.

It is probable that in many fields wide well spacing would result in slower recovery of all ultimately recoverable oil than closer spacing. Even though close spacing involves much higher costs some close well spacing pattern might result, through a saving in time and operating costs, in greater ultimate profit than wide spacing. All of the elements of comparative costs and revenues would be involved, and selections of well density programs would be subject of joint study by engineers, geologists, and economists.

Initially wider spacing.—The ends of conservation and the demands of economics would be fully served if fields or pools could be originally developed on wide spacing patterns, to determine the field limits and the reservoir and fluid characteristics. Following the studies thus made possible, infill wells could be located and drilled to provide adequate reservoir drainage and to meet the requirements of conservation, economics or expediency.

Primary vs. secondary recovery.—While this has been primarily a study of the well-spacing problem it has necessarily included discussion of orderly oil production, involving control of production rates where necessary to conserve reservoir energy. Production control has frequently

been considered to involve two possible stages of oil recovery, referred to as primary and secondary. Because the two so-called stages require the application of the same primary types of driving energy, modern thought is that there is no real necessity for dividing operations into stages and delaying the initiation of one phase of operation until another is nearly completed.

When to inject.—Limited water-drive fields or combination water-drive and gas-drive fields may require reinjection of produced brines and excess produced gas early in field life if reservoir energy is to remain at efficient producing levels. Such reinjection would tend to sustain producing rates and prolong flowing life of the wells.

When not to inject.—A field with an active water drive, showing relatively stable reservoir pressures, normally will not require fluid injection to maintain reservoir energy at efficient producing levels.

When to inject early.—If the producing mechanism is solution gas, gas cap, or gravity and it is determined early in the life of a field that artificial means of supplementing energy are desirable, pressure maintenance, rather than repressuring, is in order. Either gas or water injected into a reservoir during the early producing life as a pressure maintenance project, is much more effective than injection at a later time when reservoir pressure has declined. If early pressure maintenance is practiced, the over-all field control should be considered as primary, and so-called secondary recovery would lose its identity.

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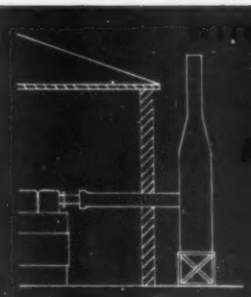

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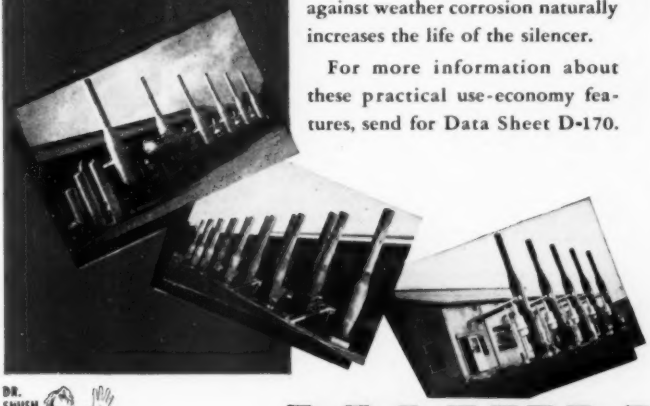

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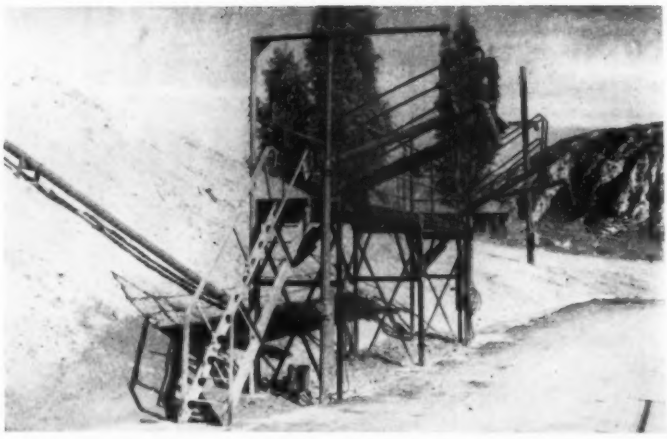


Loading rack for truck and trailer, designed for simultaneous loading.

Truck-Loading Rack Loads Quickly And With Minimum Wastage

A SUBSTANTIAL amount of the production obtained from deep wells in the Del Valle area, near Saugus, Calif., is moved from the field to refineries in the Los Angeles area with heavy-duty trucks and trailers. Pipe-line connections have not been available to these producers and loading racks have been constructed to fill vehicle tanks.

Some of this loading apparatus consists of a simple standard having a counterweighted swing at the top as a loading spout. One producer in particular has designed equipment for maximum efficiency with a minimum loss of fluid.

This rack is designed and built with standard dimensions so that both the truck and the trailer tank can be loaded at the same time so as to expedite delivery of oil from the location. This unit is all-steel construction, with the exception of the pair of walks from the rack floor to the truck and trailer tank-loading domes. The structure is set on concrete piers to provide maximum stability and permanence of operation. A steel stairway and safety rails are provided, and the loading spouts are counterweighted to move with little effort upon the truck driver.

The storage tanks are set on a graded location on the side of the hills so that oil can flow by gravity through a line leading to the loading rack. The header supplying the two filling risers lies under the soil at the front of the rack just inside the piers which support the legs of the structure. Similar risers at opposite ends of the rack contain lubricated plug valves as master cutoffs when the rack is not in operation.

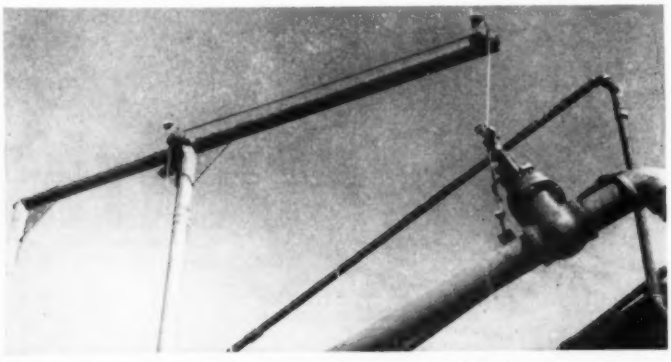
The loading swings and filling spouts are attached to the tops of of these risers with packed swing joints instead of the common screwed fittings frequently used as swing joints. Counterbalancing of these loading spouts is obtained with davit-type cranes, the vertical members of which form part of the structure.

The horizontal member of the crane is made of 2-in. pipe reinforced at the point of contact with the vertical posts with gusset plates securely welded in place. Two small sheaves with brackets are attached to the crane to handle the small soft-laid steel line attached to the loading spout at one end, and to a counter-

Counterweights are prevented from swinging by being retained in place with sleeves sliding on vertical guide post.

weight at the other. The counterweight is a short joint of lightweight 6-in. pipe with a bail at the top and closed with a flat head at the other. Adjustment for perfect balance is done by filling "bucket" with stones.

Hinged walks.—The walks from the rack platform to the trucks are hinged at the truck-side rail of the structure and are raised and lowered easily by the assistance of counterweights beneath the platform, and connected to the walks with extension sills and movable balances. The handrails on each side of both walks are anchored to the rack platform with floor fittings, which maintain the risers solidly perpendicular at this point. The opposite post, attached to the truck end of the walk, is supplied with full-swing fittings, made of steel ells, collars, and tees.



Davit containing sheaves for soft-laid steel cable to support loading pipe and counterweight.

Lost Circulation

. . . its causes and what to do about it

by H. J. Shumate*

THIS question, "What can we do about lost circulation?" is becoming more common each day, as we drill ever deeper in the search for the petroleum necessary to maintain adequate reserves in face of the increasing demands of the national economy and the preparedness program.

As deeper zones are penetrated with greater regularity, we find lost circulation consuming an increasing amount of rig time, man-hours, and money. Lost circulation is not new; it is as old as the rotary-drilling industry which is now spotlighting it, but it becomes more serious as we are forced to greater depths and more expensive wildcatting programs to fulfill current and future needs.

Lost circulation may be divided into two classes: first, those of a mechanical nature resulting from drilling techniques employed; second, those inherent in the formation and merely awaiting penetration of the bit.

The mechanical type is considered to be an artificially induced loss, caused by employment of high-density muds used for drilling abnormal pressure zones; pressure surges resulting from pipe movements, balling, high gel strengths, pumping methods, reduced annular clearances, or a combination of two or more of the conditions listed.

Losses of the second type may occur when drilling loosely consolidated sands or uncemented gravel beds, lime rocks containing solution (sometimes cavernous) porosity developed by exposure to water, and cracks or fissures resulting from earth stresses. Mechanical factors are, of course, present and exert a strong influence on the gravity of the second type of loss, though some may be held to have been unavoidable by virture of their inherent characteristics.

In an attempt to combat the terrific additional expense of lost circulation attendant on drilling in zones of known abnormal pressure along the Gulf Coast of Louisiana and Texas, an intensive study of the character of these losses was begun. The most effective remedy for lost circulation is, of course, to prevent it, but before this could be done a proper diagnosis would have to be made.

*Zone drilling engineer, Gulf Oil Corp., Odessa, Tex. Presented at eleventh annual meeting, American Association of Oilwell Drilling Contractors, Fort Worth.

It had been noted that, in many cases of loss, the hole would remain full and sometimes it was possible to restore circulation by the simple expedient of making a trip to change bits, time alone seeming to make the necessary repairs to the hole. In other instances the loss had been preceded by a perceptible slowing of the pump, indicating a restriction in the flow of the mud. These factors lent weight to the theory that fractures were being created by an excessive pressure greater than the tensile strength of some of the formations to which it was exposed.

Test Well

Engineers were assigned to a test well in the Peach Point field of Brazoria County, Texas, where high-density mud would be required and equipment was installed for recording mud weight, pit level, drilling speed, circulation rate, bit weight, pump pressure, pump strokes, rotary speed, and rotary torque. There were 22 instances of loss recorded during the drilling of this well, and 14 were found to be directly associated with balling or movement of the drill pipe.

In the majority of these losses the hole remained full, indicating the formations were capable of supporting the 17.5 lb. per gal. mud being used, and that pressures in excess of the hydrostatic pressure were being required to rupture the formation.

Information as to the magnitude of pressure surges resulting from pipe movements was not available, so a decision was made to determine the connection these movements might have with mud losses.

A sub was made to replace the bit in the drill string and two recording pressure gages were attached. Tests were run inside casing to determine effects of rapidly running and withdrawing drill pipe, spudding while pumping, and rapid opening of pumps to start circulation. Pressures obtained were equivalent to an increase in mud density of 1.3 and 2.3 lb. per gal., respectively, during rapid lowering of one stand of pipe and rapid lowering of the kelly while pumping. Pressure surges equal to ⅛ lb. per gal. increase over initial circulation pressures occurred when the pump was opened wide immediately on starting circulation. Pressure decreases, due to withdrawals, were not great, usually being less than 50 psi. at all depths.

These surge tests were conducted in oil-emulsion muds of low viscosity, low gels, and low density, and obviously would have been of a higher order in fluids of less favorable character.

As a result of the information obtained from test wells, plans were made to employ drilling techniques that might serve to reduce the frequency of losses in the next abnormal pressure well.

The well chosen for the trial effort was 1 J. F. Perry Unit, in Peach Point field. Oil-emulsion mud was used to eliminate balling by preferential wetting of the drill string. Increased annular clearances were obtained by use of streamlined drill pipe and removal of the rubber protectors. Reduction in pressure surges was made possible by slowing the entry of the drill pipe in the hole from the normal 15-second per stand running time to 35 or 40 seconds; by starting the pumps after the kelly was lowered; by adoption of a no-spudding rule; and by slowly opening the pumps when circulation was started.

Successful completion of the well without a single loss of circulation, as compared with a previous history of 79 losses on three prior wells in the same field, gave ample justification for the control methods employed.

Losses of circulation occurring in porous, cavernous, or fractured formations are difficult to avoid, sometimes difficult to cure, and in extreme cases, have been known to result in abandonment. Losses of this type are prevalent in the Permian basin.

At the present time the most frequent losses are encountered in the Midland basin. The increased tempo of drilling occasioned by Spraberry, Pennsylvanian, and Ellenburger discoveries has resulted in this becoming the most active area in West Texas, and costs attributable to lost circulation have mounted greatly.

Wells drilled on the Central Basin platform lose mud regularly in zones containing solution porosity, while the Delaware basin, which has not yet been widely explored by deep wildcatting, promises to be equally interesting and difficult to drill when activity in that area increases. The majority of the deep wells drilled in

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the Delaware basin have reported trouble in maintaining circulation, and some of these losses have been severe in the extreme. One well that penetrated the Ellenburger on the western side of the basin reported 46 losses, totaling 12,985 bbl. of mud. Worthy of note is the fact that that particular mud never weighed over 9.0 lb. per gal. and contained at all times as much sealing material as the pumps could handle.

It has been stated before that lost circulation is either mechanical, and caused by drilling methods, or arises from conditions inherent in the formation which, in many instances, have been aggravated by mechanical factors.

Once a loss has occurred, interpretation must be made before the proper remedial procedure can be undertaken. Instruments recording pit level and pipe movements are particularly helpful in making this interpretation, but if the loss is of a serious nature, knowledge of the point of loss should be obtained if possible.

Methods used for determining the point of loss are:

1. **Temperature survey.**—This requires forcing mud out of the hole by pumping cool mud from the surface. This method is expensive and has brought inconclusive results.

2. **Radioactive tracer.**—Carnotite has been added to the mud and pumped down the drill pipe along with remedial squeeze mixtures, followed by a gamma-ray survey. The Carnotite resulted in radioactivity being scattered throughout the mud system and wall cake, and was discontinued because of negligible results.

3. **Spinner survey.**—This method has proved most helpful, but requires large volumes of mud, and is ineffective where large quantities of sealing materials are present. It is sometimes necessary to displace the entire volume of the hole from the top with mud containing no sealing materials before a reading can be obtained.

4. **Resistivity survey.**—An electrical survey employing the principle of resistivity has lately been developed that gives promise of locating the point of loss without much waste of mud. It has particular significance in that it is not subject to clogging with sealing materials or shale particles. The author observed the use of this instrument on a well bottomed at 10,432 ft., where two points of loss were established. The first loss was from 7,925-50 ft., and the second from 8,340-50 ft. The survey required only 2 hours of rig time and 160 bbl. of mud for running.

When interpretation as to cause has been made, curative measures are selected. Some of the most promising remedies are listed, not necessarily in order of importance:

1. **Sealing agents.**—The use of these materials is usually the first method employed, and in losses to zones of low permeability are usually adequate. Concentrations ranging from 5 to 35 lb. per bbl. are commonplace. More than one type is necessary to achieve a variety of patterns and an effective gradation in particle size.

2. **Equalization cementing.**— This procedure has especial significance in West Texas, where the fluid levels frequently drop considerable distances down the hole. The mud level is determined by running a float or short piece of spinning chain on a measuring line down the inside of the drill pipe. Calculation of the hydrostatic head is then made from the known weight of the mud. Tubing or drill pipe is then placed at a sufficient height above the loss so that when the cement and the displacing fluid reach a point of equalization about half of the cement will remain in the hole to be drilled out.

3. **Diesel oil - bentonite squeeze.**— This method necessitates use of a cement truck for mixing approximately 300 lb. of bentonite per barrel of oil, and is pumped through the drill pipe to a point just above the loss where it is permitted to contact with the water or mud in the hole. At contact with the water or mud the oil is forced out and the result is immediate hydration of the bentonite which then forms a tough plug capable of sealing off a large loss.

An interesting variation consists of mixing 300 lb. of gypsum cement in a barrel of oil and following the procedure outlined above. If the thief formation is a dry one, it would be necessary to pump water into the formation ahead of the mixture to provide the proper hydration fluid. This adaptation offers a way to overcome the time and temperature factors controlling the setting of this cement. Since no hydration takes place in the oil, it will remain pumpable for any length of time that it is not in contact with water or mud. It is necessary to pump oil spacers ahead and behind either type of mixture, to avoid plugging the drill pipe. Best results are obtained from a ration of 4 bbl. of squeeze mixture to one of the hydrating fluid.

4. **Oil-emulsion muds.**—One of the most important developments in the rotary-drilling industry of the last few years has been the increased use of oil-in-water-type emulsions for better drilling-fluid control. Chemical emulsions made from water-base muds to which 10 to 15 per cent by volume diesel oil, containing a soap emulsifying agent, has been added have enjoyed signal success in elimination of balling and reduction of pipe drag, rotary torque, and circulating pressures in soft-shale formations.

Emulsions have been slower to come into favor in West Texas than on the Gulf Coast, because electric logs do not give as complete a picture as they do on the coast, hence the Permian basin geologist is forced to rely mainly on surface examination of samples and drill-stem testing done as a result of this examination.

Since fluorescence in the samples is one of the important conditions upon which drill-stem tests are based, artificial fluorescence imparted to the samples by oil in the mud could prove costly on wildcat wells.

In field wells where geological control has been established, both stable and mechanical emulsions are gaining recognition as an aid in reduction or prevention of circulation losses. It is possible by the use of oil to maintain muds as light or lighter than water, and this is of particular significance in wells which will not even support the weight of water.

Current steel shortages have made necessary curtailment in the use of casing, and by use of crude oil to reduce weight operators have been able to eliminate the salt strings from their casing programs in some of the Spraberry sand developments. Open salt sections produce a mud that will weigh in excess of 10 lb. per gal. when complemented by the formation solids. In an area where 9.0 lb. per gal. mud is the maximum fluid weight that it is possible to circulate, addition of 25 to 40 per cent crude oil and a small percentage of zeolite clay has enabled operators to achieve the drastic weight reduction necessary. A better emulsion will result if 2 or 3 lb. per bbl. of starch is also added. Defoaming agents are usually necessary in these muds, the most effective of which is octyl alcohol, and when added in a ratio of 1 part to 10,000 will reduce foam sufficiently to make pumping possible.

5. **Drilling with gases.**—The author was privileged to observe a well drilled with compressed air in Martin County, Texas, and also wells using gas in the San Juan basin of northwestern New Mexico.

On the Martin County well, air was provided by portable compressors in two stages of compression and injected into the well at a rate of about 40,000 cu. ft. per hour. Because of the low volume it was necessary to drill by reverse circulation with 2⅜-in. tubing, and then considerable difficulty was experienced from plugging. The entire Spraberry section was drilled by this method with no liquid being introduced into the hole other than that provided by the formation itself. A total of 922 ft. was made with 20 bits in 148 rotating hours.

In Blanco gas field of New Mexico, the introduction of gas as the circulating medium has met with spectacular success. Operators were plagued with so much trouble from lost circulation in drilling the Cliff House, Menefee, and Point Lookout sands in the Mesa Verde sections of the Upper Cretaceous that mud costs sometimes ran as high as $20,000, and

(Continued on page 146)

15 CORROSION CASE HISTORIES

in petroleum refineries

by John F. Mason*

These problems outlined here are typical of many that have been encountered with corrosion of refinery processing equipment and as demonstrated they can often be solved by referring to available information and data obtained by an experienced corrosion engineer under the same or similar conditions. On occasion a situation is involved whereby no clear-cut answer to the problem is evident because of the lack of either practical experience and or available data and under these circumstances it is necessary to resort to the use of spool-type specimen holders for such information as may be obtained.

The advantageous use of these assemblies should be encouraged once the details of the problem are established and a check on the sources of existing data discloses no pertinent information under the particular set of corrosive conditions that might be used as a basis for selecting suitable metals and alloys for the environment in question.

CORROSION of equipment in petroleum refineries has for many years represented a major portion of operating costs and oftentimes this condition has been aggravated by the misapplication of available metals and alloys. Over the past 25 years the corrosion engineering section of International Nickel Co. has been active in investigating corrosion problems in the petroleum industry and considerable quantitative information has been obtained on the behavior of different materials of construction under varying conditions of service. It is the purpose of this paper, therefore, to present an analysis of 15 actual problems concerning corrosion of refinery equipment that were submitted for consideration. The solutions to the problems are based on the accumulated practical experience of the staff of the corrosion engineering section as well as on such quantitative test data as we have developed in refinery services through the use of our spool-type specimen holders.

Briefly, the assembly consisted of previously cleaned and weighed specimens of the several metals and alloys to be tested, mounted on the spool-type holder with nonmetallic parts of bakelite or porcelain to separate and insulate the specimens from each other and from the metallic parts of the holder.

Two similar specimens of each material were included on each spool. The completed test assemblies were fastened firmly in place in the desired test locations in operating plant equipment and allowed to remain for sufficient lengths of time to give reliable indications of corrosion behavior. Each of the test specimens used had an exposed area of 0.5 sq. dm.

Upon completion of tests, the spools were removed, dismantled, and the specimens examined, cleaned of all scale and corrosion product, and reweighed. From the weight losses, areas of specimens and duration of exposure, the corrosion rates were calculated in terms of milligrams per square decimeter per day, and these rates transposed to inch penetration per year (i.p.y.), the unit used in the accompanying tables. This unit is based upon the assumption of uniform corrosion in practice from one side of the metal only.

The rate shown for each material is the average of the two specimens included in each test. In addition, each specimen was examined for cracking, pitting, and other forms of local attack. Where pitting or local attack occurred, depths of the 5 or 10 deepest pits was measured microscopically or with a depth gage. This method of test was substantially in accord with A.S.T.M. Recommended Practice for Conducting Plant Corrosion Tests, A224-41.

Problem 1. Heat Exchanger

Materials used.—Steel tubes with 0.095-in. wall in a heat exchanger used in combined straightrun and cracking distillation service gave a life of only 9 months when failure occurred due to pitting and general corrosion, particularly where the tubes passed through the steel baffle plates. Muntz metal tubes were used as replacement and the life was increased from 3 to 5 months.

Service conditions.—Tube interior: Gas oil having 0.6 to 0.8 per cent organic sulfur compounds. Tube exterior: Depropanized naphtha containing 0.035 to 0.10 per cent organic sulfur including 4-40 mg. RSH/100 cc. plus trace of H_2S. Temperature: 350°-600° F. (average 450° F.). Operating pressure: 225 psi. inside tubes and 40 psi. outside. Aeration: None.

Discussion.—Depropanized naphtha per se is not considered to be particularly corrosive even at elevated temperatures and, therefore, the problem resolves itself into a consideration of the effect of the organic and inorganic sulfur compounds in promoting corrosion of mild steel and Muntz metal. No quantitative test data were available under the actual service conditions described. But an opportunity was provided to expose some specimens of various metals and alloys on our standard spool-type specimen holders in naphtha contained in the sump of the top tray of a topping unit and in the bottom of a fractionating bubble tower wherein sulfur compounds were present at elevated temperatures. It is believed that these conditions are somewhat analogous to the problem application to indicate the probable suitability of other materials for the service in question. The test conditions and results are as follows:

Test 1.—Specimens exposed for 538 days in sump of the top tray of a topping unit to naphtha containing 0.008 per cent sulfur plus traces of H_2O and H_2S. The temperature varied between 290° and 360° F. with an average of 320° F. and the velocity was 6 in. per second.

Test 2.—Specimens exposed for 75 days in bottom of fractionating bubble tower handling oil with a sulfur content of 0.751 per cent and a boiling range of 164° to 600° F. at normal pressure. The temperature varied between 675° and 700° F. with an average of 690° F. Aeration was nil and agitation was turbulent.

TABLE 1—TEST RESULTS, PROBLEM 1

Material—	Indicated corrosion rate-inch penetration per year		
	Test 1	Max. pitting during test, in.	Test 2
Monel	0.0003	None	(*)
Nickel	0.0001	None	(*)
Inconel	0.0001	0.003	0.0022
Types 302 and 304 S.S.	0.0001	0.008	0.0003
Type 316 S.S.	0.0001	0.006	
Mild steel	0.0031	0.021	0.144
Type 502 S.S.			0.017
Type 410 S.S.			0.0015
Red brass			(*)
Admiralty metal			0.0059

*Specimens, originally 0.031 in. thick, were completely destroyed during test period.

The data from Test 1 indicate that while the general corrosion resistance of mild steel is of a satisfactorily low order, it has a strong tendency to suffer severe localized attack in the form of pitting. The chromium-containing materials such as Inconel and the austenitic stainless steels also showed the same tendency but to a

*Corrosion engineering section, development and research department, International Nickel Co., New York. Presented at A.S.M.E. petroleum mechanical engineering conference, Tulsa, September 1951.

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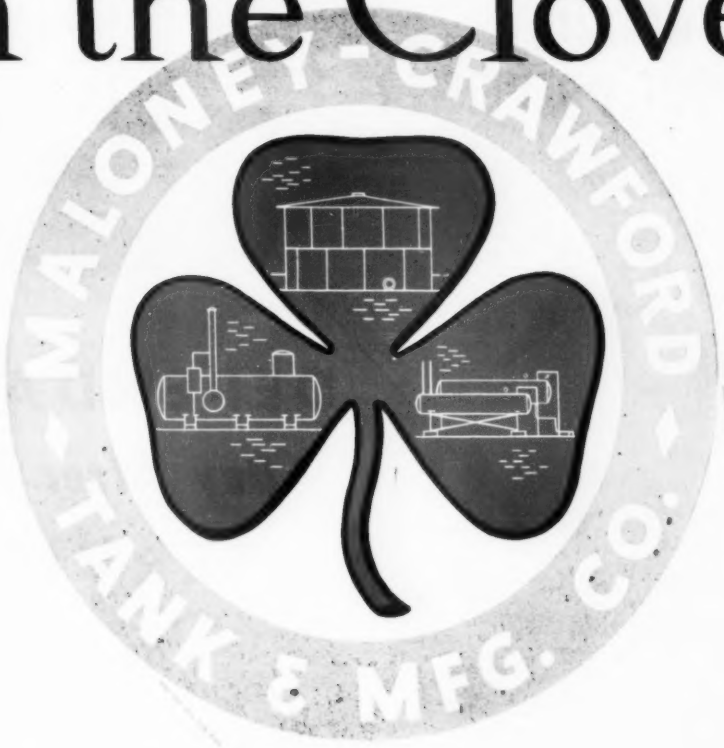

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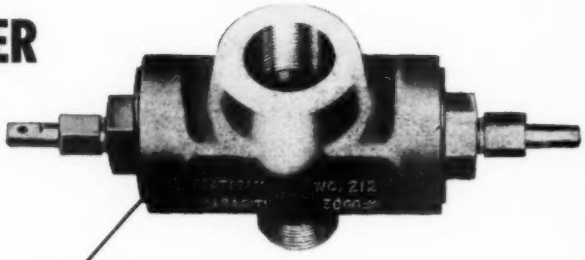

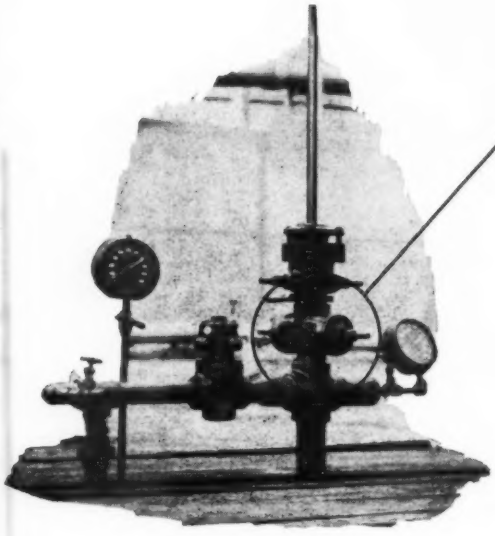

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much lesser degree. Monel and nickel were free of this type of attack and in addition showed negligibly low over-all corrosion rates based on weight loss at this temperature.

In Test 2 none of the specimens showed any evidence of pitting attack but it will be observed that mild steel was subject to a high rate of corrosion. Monel and nickel cannot be considered for the application because as shown by the data in this test they are susceptible to severe general and intergranular attack by sulfur compounds at temperatures much in excess of 500° F. It was mentioned that Muntz metal tubes were substituted for mild steel and that an additional 3 to 5 months' life was obtained.

It was not reported how these tubes failed but if it was caused by dezincification, there is a good possibility that inhibited admiralty metal will give greatly superior performance since its general corrosion rate in Test 2 was only 0.0059 in. per year. Another material worth while considering is Type 502 stainless steel which showed a superiority over mild steel of about 10 to 1. By increasing the chromium content to 13 per cent (Type 410 stainless), the ratio is extended to approximately 100 to 1. It seems that the latter materials would probably represent the more economical investment.

The accelerated corrosion that occurred on the steel tubes where they passed through the baffle plates was in all probability caused by concentration cell corrosion of the metal-ion type. In practice, these cells are usually set up by differences in the rate of movement of the corroding solution, or, more effectively, by movement of one part of the solution while another part remains practically stationary. In this way, the stagnant portion in the crevice between the tubes and baffle plates becomes saturated with products of corrosion, or metallic ions, while the moving portion sweeps them away leaving the solution low in concentration of corrosion products. This condition sets up a flow of electric current which causes galvanic or accelerated corrosion of the metal in the region where a relatively low ion concentration is maintained, that is at the edge of the juncture of the tubes and baffle plates.

Problem 2. Heat Exchanger

Material used. — Steel tubes with 0.095-in. wall in a heat exchanger used in combined distillation and cracking service gave a life of 12 months when pitting occurred on the outside surface and accelerated corrosion where the tubes passed through the steel baffle plates.

Service conditions.—Tube interior: Crude petroleum with 0.3 to 0.5 per cent organic sulfur. Tube exterior: Gas oil having 0.6 to 0.8 per cent organic sulfur compounds. Temperature: —10° to 650° F. (average 450° F.). Operating pressure: 225 psi. inside tubes and 300 psi. outside. Aeration: None.

Discussion.—This case of pitting and corrosion of the outside of the tubes by gas oil containing organic sulfur compounds is similar to Problem 1 and the same comments would seem to apply. In other words, there is every indication that Types 410 and 502 stainless steel as well as inhibited admiralty metal will provide much better performance in the service in question than mild steel.

Problem 3. Heat Exchanger

Material used. — Steel tubes with 0.095-in. wall in a heat exchanger used in conjunction with a sulfuric acid alkylation unit gave a life of 3 to 4 months when failure occurred at junction of tubes and steel tube sheet on acid side.

Service conditions.—Tube interior: Steam at 140 psi. Tube exterior; Black alkylation spent acid 89.91 per cent H_2SO_4, 98 per cent fresh acid added to bring concentration to 92 per cent. Temperature: 300° F. maximum, 200° F. average. Operating pressure: 140 psi. inside tubes and 65 psi. outside.

Discussion.—The point of failure is typical of concentration cell corrosion of the metal ion type as discussed in Problem 1. High concentration of sulfuric acid over about 80 per cent and low moderate temperatures are favorable for the satisfactory performance of mild steel except where conditions of high velocity or turbulence are encountered. The effect of the latter forces is to remove the protective ferrous sulfate coating that forms. However, it generally is not practical to use mild steel with concentrated sulfuric acid solutions at elevated temperatures up to 300° F. even under quiet or stagnant conditions because of excessive corrosion attack. Usually its application is confined to temperatures under about 120° F.

Type 316 stainless steel and Carpenter 20 while also resistant to concentrated sulfuric acid solutions even under velocity conditions cannot be used safely at temperatures in excess of about 180° F. Under the circumstances, it seems apparent that the only material that might be considered worth while for the application in question is Hastelloy B, which is reported to have fair resistance to corrosion by concentrated solutions of sulfuric acid at temperatures up to 300° F. The silicon irons, such as Duriron and Durichlor, as well as Hastelloy D would also demonstrate adequate resistance to attack but these materials are available only in cast form and would not readily lend themselves to use as heat-exchanger tubing.

Another possibility is the use of Karbate tubing but this material is somewhat brittle and care must be exercised in the handling of it. Apparently since the corrosive conditions are so severe and the availability of materials in wrought form is rather limited for tubular elements in a heat exchanger, it might be considered practical to redesign the unit along the lines of the standard sulfuric acid concentrators in refineries where the evaporator bodies usually are of steel, lined with lead and this covered with acid resistant brick. The heater tubes or thimbles commonly are of Hastelloy D and other parts of Duriron, Corrosiron, and carbon are used.

Problem 4. Regeneration Tower

Material used.—Carbon steel, lye regeneration tower with cast iron trays and bubble caps. The steel distributor pipe on the unregenerated lye inlet was completely corroded away and was replaced with a splash plate located 4 ft. from the nozzle or 1 ft. from the opposite side of the tower. A hole ⅜ in. in diameter, developed in the tower shell directly opposite the inlet nozzle. This hole was in the upper part of a badly corroded area 6.5 by 10 in. with lesser corrosion over a large area. The splash plate had been corroded through over an area 8 in. in diameter. At present, this tower has been in service over 2 years.

Service conditions.—Regeneration of lye or caustic soda of 20° B. (15 per cent) containing mercaptans and hydrogen sulfide. Temperature: At bottom of tower 270° F. At top of tower 240° F. Operating pressure: 20 psi. Aeration: Moderate.

Discussion.—Carbon steel as well as cast iron is generally subject to severe corrosive attack in contact with caustic soda solutions at elevated temperatures. The presence of velocity or turbulence in such equipment tends to accelerate corrosion. It seems evident that the latter effects caused premature failure of the distributor pipe and impingement attack shortened the life of the area in the tower shell opposite the inlet nozzle as well as the splash plate.

Given below are the results of some plant corrosion tests in caustic regeneration units:

Test A.—In reboiler of caustic soda regenerator unit. Solution entering contained 1-2 per cent sodium hydroxide, 3 per cent phenolate and 0.07 mg. per 100 cc. of solution as sodium mercaptides. Test specimens were located directly above Monel heating tubes. Temperature 255° F. Duration of test 131 days.

Test B.—In vapor section of caustic soda regeneration unit. Solution entering contained 13.2 per cent sodium hydroxide, 0.37 per cent sulfide sulfur, and 0.80 per cent mercaptide sulfur. The average temperature was 300° F. The duration of test was 55 days.

Test C.—In reboiler of caustic potash regenerator unit. Solution entering contained 25.5 per cent potassium hydroxide, 37.8 per cent potassium isobutyrate, 5.5 per cent potassium sulfide, 1.9 per cent potassium mercaptides, and 2.1 per cent potassium carbonate. Test specimens were located in boiling liquor at upstream side of overflow weir. Average temperature 286° F. Duration of test 140 days.

Test D.—Same as "C" above except test specimens were exposed in vapor at downstream side of overflow weir. Average temperature 286° F. Duration of test 140 days.

It will be noted that in one test, mild-steel specimens, originally 0.062 in. thick, were completely destroyed in 140 days while in the other three tests the corrosion rates of the material were of a relatively high order. Monel and Inconel gave out-

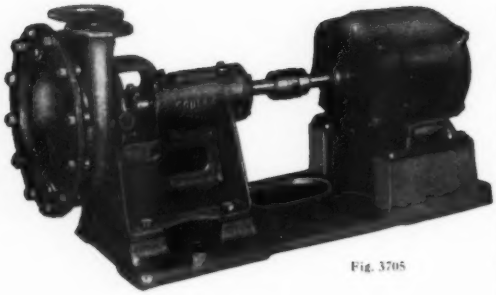

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TABLE 2—TEST RESULTS, PROBLEM 4

Material—	Corrosion rate, inch per year			
	Test A	Test B	Test C	Test D
Monel	.001	.002	.003	.002
Nickel	.024	.002	.022	.016
Inconel	.0001	.0003	.001	.002
Mild steel	.020	.033	(*)	.012
Ni-Resist (Type 1)	.023	.013	.046	.019
Cast iron	.017		.040	.014

*Specimens completely destroyed during test, original thickness of specimens 0.062 in.

standing performance and as a matter of fact Monel is being rather widely used in the petroleum industry for caustic soda regenerator reboilers and tubes, for lining the bottom sections of regenerator towers and for pumps, piping, and preheaters handling the hot solutions. Inconel has also proved to be a useful material for evaporator tubes or other parts of regenerator systems and should be used rather than Monel in this service where metal temperatures in excess of 500° F. are encountered since Monel is subject to sulfur embrittlement at higher temperatures.

In view of the difficulties described with mild steel and the proved outstanding performance of Monel under such conditions, it was suggested that the affected parts of the tower be replaced or lined with Monel.

Problem 5. Flash Tower

Material used.—Carbon steel piping, 10-in. diameter by ½-in. wall in a crude flash tower handling Quiriquire crude suffered a loss of 3/32 in. in a year accompanied by severe pitting and a gouging effect.

Service conditions.—The crude is charged to the flash tower at a rate of 25,000 W.G. per hour and at a viscosity of 400 seconds at 100° F. Saybolt. The crude is reported to contain organic acids (naphthenic acids), chlorides and sulfides. Temperature: 580°-630° F. (average 600° F.). Operating pressure: 15 psi. Aeration: None.

Discussion.—Naphthenic base crudes such as Quiriquire and Monaca have proved to be highly corrosive at elevated temperatures. Some plant corrosion tests have been made in the processing of these crude and the following data have been obtained:

Test 1.—Specimens exposed for 17.5 days in a second-stage separator of a combination unit handling cracked petroleum gas oil from Monaca crude containing combined sulfur up to 1.27 per cent as H_2S, mercaptans and organic sulfides. The temperature was 750°-780° F. with an average of 760° F. and the flow varied between 17,000 to 21,500 W.G. per hour through a 6-in. i.p.s. line.

Test 2.—Specimens exposed for 196 days in a first-stage intercondenser of a combination unit handling cracked petroleum reduced crude containing up to 1.1 per cent sulfur as H_2S, mercaptans, plus organic sulfides. For 131 days Monaca crude was being processed during the test and for 65 days Quiriquire crude. The temperature was 790°-820° F. with an average of 800° F. and the flow varied between 16,000 to 18,000 W.G. per hour through a 12-in. extra-heavy pipe.

The temperature conditions of the tests are somewhat higher than in the problem

TABLE 3—TEST RESULTS, PROBLEM 5

Material—	Indicated corrosion rate-inch penetration per year	
	Test 1	Test 2
Monel	0.238	(*)
Nickel	0.232	(*)
Inconel	0.0074	0.0092
Type 302 S.S.	0.0042	0.0023
Type 316 S.S.	0.0037	0.0022
Type 430 S.S.	0.0060	0.0003
Type 502 S.S.	0.030	0.0071
Cast iron	0.043	0.054
Mild steel	0.095	0.027

*Specimens originally 0.031 in. thick were completely destroyed during test period.

application but the data might serve to indicate the relative behavior of the various materials investigated. It will be observed that in Test 1 mild steel showed a corrosion rate of 0.095 in. per year which is almost identical with the 3/32-in. loss per year reported for the 10-in. piping in the service in question. Apparently, some improvement of the order of 3 to 1 would be provided by the substitution of Type 502 stainless steel and, of course, the higher chromium content alloy, Type 430, as well as the austenitic stainless steels and Inconel would give superior performance. It should be noted the powerful effect sulfur compounds at elevated temperatures, above 500° F. have on Monel and nickel in causing accelerated corrosion.

Problem 6. Lead-Lined Agitator

Material used.—Here 10-lb. lead was used on walls and 14-lb. lead was applied on cones of steel shell light-fuel-oil agitators. The lead lin-

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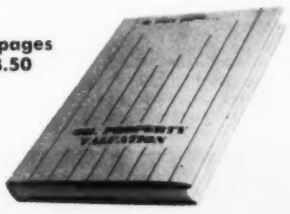

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ing on the walls is replaced every 5-6 years and the lining on the cone shaped bottoms every 3-5 years. The agitator roofs are replaced approximately every 3 years. Considerable patching is required during the life of the linings and corrosion of the underlying steel shell occurs through holidays in the linings.

Service conditions.—Treating light fuel oils with one of the following: 93-98 per cent H_2SO_4, 2-10 per cent sodium hydroxide, and 19-25 per cent sodium plumbite solution. In addition the oils contain mercaptan sulfur, elemental sulfur, and polysulfides. During acid treating the batch is agitated with air for 15 minutes, and during lye treating the batch is agitated with air for 6 to 12 hours. It was also reported that the batches contained small quantities of elemental sulfur and lead sulfides as suspended solids and that a maximum copper pickup from the equipment of 0.5 p.p.m. copper can only be tolerated. The temperature of the acid batch varies between 65° and 95° F. with an average of 75° F. and of the lye batch between 120° and 130° F. with an average of 125° F.

Discussion.—In these batch operations the same vessel was used for acid washing, neutralization and "doctoring" for removal of traces of mercaptans. A plant corrosion test was made in a batch vessel in which the acid treatment, water washing, and caustic treatment were all carried out in the same unit and agitation was done with air. Given below are the test conditions and the results obtained together with some data from a sodium plumbite solution:

Test 1.—Specimens immersed 3 ft. above bottom of cone in fuel-oil treating tank during treatment with 4 lb. per bbl. of 66° B. sulfuric acid followed by water washing and treatment with 10° B. caustic soda. Agitated with air. Temperature 80°-105° F. Duration of test 56 days.

Test 2.—Specimens installed in an agitator and immersed in sour gasoline, mixed with a sodium plumbite solution for the removal of mercaptans and H_2S. Moderate aeration and high agitation. Temperature 60°-80° F. (average 70° F.). Duration of test 150 hours' actual operation but spool was installed for 125 days.

TABLE 4—TEST RESULTS, PROBLEM 6

Material—	Test 1	Test 2—Indicated corrosion rate-inch penetration per year	
		Based on 150 hours	Based on 125 hours
Monel	0.018	0.0002	0.0001
Nickel	0.037	0.0002	0.0001
Inconel	0.016	0.0001	0.0001
Worthite	0.012		
Hastelloy A	0.003		
Chemical lead	0.038	0.073	0.0037
Type 1 Ni-Resist	0.036	0.0008	0.0001
Cast iron	0.056	0.012	0.0006
Mild steel	0.021	0.010	0.0005

Test 1 data indicate that Hastelloy A was the best of the materials tested, followed by Worthite, Inconel, and Monel. It should be mentioned that Monel is being widely used in this service particularly where mechanical agitation is employed. Air agitation increases somewhat the corrosion rate of Monel during the acid treating cycle, although it is not excessive because of the relatively short time of contact of only 15 minutes with the media during the cycle. While Inconel showed comparable corrosion resistance with Monel in the test we would prefer to see the latter material used in such service because of its better reliability in contact with dilute solutions of sulfuric acid.

In practice, while concentrated sulfuric acid is added to the oil batch, it is readily diluted down by picking up water from the oil and usually must be further diluted with water to accomplish good separation of the acid sludge after treatment, so that water solutions of acid concentration down to 5 or 10 per cent may be encountered in the separation systems. Monel is not resistant to attack by sulfuric acid solutions in excess of about 80 per cent concentration at atmospheric temperature and when 66° B. acid is added to an oil batch care is exercised to avoid any contact of it with the side walls of the Monel vessel until it has had a chance to mix with the oil.

The Hastelloy alloys are rather expensive and in the event this might eliminate them from consideration, the next most logical replacement material for chemical lead is Monel, which based on the test results should give better than twice the life of the present equipment without the necessity of continual patching. The ultimate performance of Monel could be considerably improved by providing mechanical agitation during air blowing in the acid washing cycle, thereby also reducing the amount of copper pickup to a minimum.

In referring to Test 2 wherein the corrosive was sour gasoline mixed with a sodium plumbite solution it will be noted that lead was the poorest of the materials tested and it is this metal of which the equipment was constructed. Here again, the indications are that Monel would probably represent the most practical and eco-

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nomical material to use in this particular service. For cast equipment such as pump bodies and valves, Ni-Resist would seem to be an excellent choice as it showed up to be more than 10 times better than cast iron as well as mild steel.

Problem 7. Cracking Coil

Material used.—Extra heavy 12-in. carbon-steel pipe with ½-in. wall used as a tube and tank cracking coil failed in 1½ to 2 years due to general corrosion by vapors in bends leading from the top of the separator to the high-pressure exchangers.

Service conditions.—Pipe handles reduced crude vapor containing mercaptans, H_2S, free sulfur, SO_2, and chlorides. Temperature: 730°-740° F., average 735° F. Operating pressure: 70 psi. Aeration: None.

Discussion.—The change in flow of vapors in the pipe at bends evidently sets up a more or less turbulent condition at these locations which causes accelerated corrosion of steel through the mechanism of removing or preventing the formation of protective corrosion product films.

No data were available to illustrate the effect of velocity on steel in the service in question but the following plant test data were obtained under turbulent conditions and they will give some idea as to what materials might be used to better advantage by providing additional corrosion resistant insurance.

Test 1.—Specimens exposed in cracking-coil fractionator for 197 days to reduced crude oil having an average sulfur content of 0.21 per cent and an average A.P.I. gravity of 29°. Temperature: 700°-720° F., average 715° F. Aeration: None. Agitation: Turbulent.

Test 2.—Specimens exposed in cracking coil fractionator for 122 days to reduced crude-oil vapors having an average sulfur content of 0.6 per cent. Temperature: 575°-600° F., average 590° F. Aeration: None. Agitation: Turbulent.

TABLE 5—TEST RESULTS, PROBLEM 7

	Indicated corrosion rate-inch penetration per year	
Material—	Test 1	Test 2
Monel	(*)	(*)
Nickel	(*)	(*)
Inconel	0.0008	0.0015
Type 302 S.S.	0.0001	0.0004
Type 410 S.S.	0.0006	0.0015
Type 502 S.S.	0.0033	0.0051
Hastelloy A	0.0002	0.0004
Mild steel	(†)	0.018
Type 1 Ni-Resist	0.058	0.025
Cast iron	0.052	0.024

*Specimens originally 0.031 in. thick, were completely destroyed during test period.
†Specimens originally 0.062 in. thick, were completely destroyed during test period.

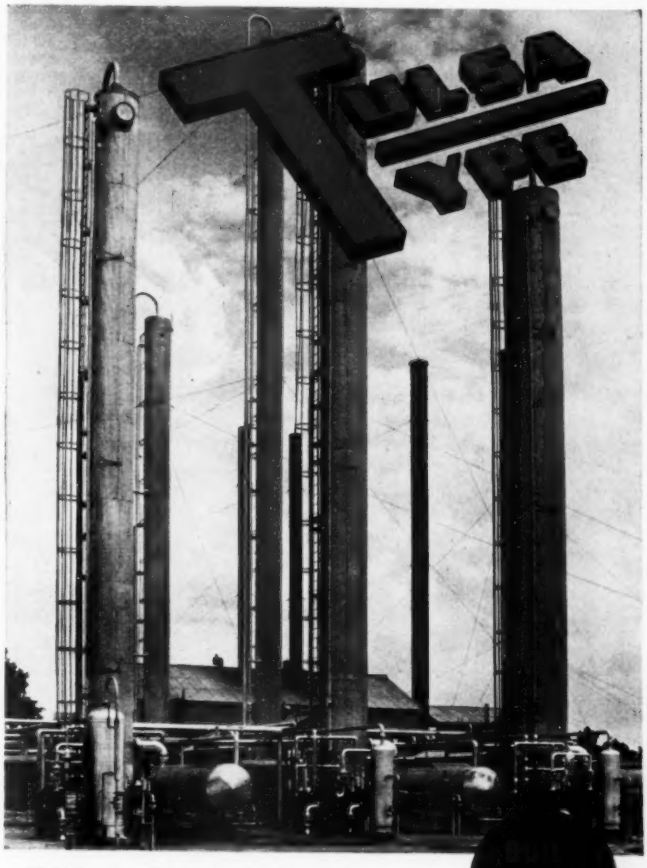
The data indicate that under some conditions mild steel can suffer exceedingly high rates of attack and if reference is made to Test 1 it will be noted that specimens of this material, originally 0.062 in. thick, were completely destroyed during the exposure period of 197 days. Under the same conditions Type 502 stainless steel gave very satisfactory performance and would seem to be the most practical and economical material to use to replace the present steel piping. There does not appear to be any necessity in going to the more highly alloyed and more expensive materials for the service in question.

Problem 8. Propane Accumulator

Material used.—Carbon steel, propane (cracked distillate) accumulator with an acidproof cement lining (Vitric No. 10). It is reported that general corrosion and severe pitting occurs with a loss of about 1/64 in. per year.

Service conditions.—Two phases in accumulator: Liquid phase—small percentages of sulfides and chlorides having an acidity of 1.0 mg. of KOH per gram with an average pH of the water settlement 4.4. Gas phase—petroleum gas containing methane, ethane, propane, butane, and a small percentage of H_2S. Temperature: 75°-90° F., average 80° F. Operating pressure: 60 psi. Aeration: None. Agitation: 8,000 W.G. of distillate charge per hour.

Discussion.—We presumed that corrosion of the steel beneath the coating occurred through porosity or bare spots that were not covered initially. The corrosion was evidently caused



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by hydrolysis of the chlorides to form small amounts of hydrochloric acid. While no data were available from a propane accumulator some were developed in a rerun gasoline condensate accumulator and in a reflux water separator where the water layers contained some HCl and H_2S. The test conditions and results are given below:

Test 1.—Specimens exposed for 59 days in a rerun gasoline condensate accumulator where the water layer contained some HCl and H_2S. The pH of the water varied from 2.1 to 6.5 and the temperature 70°-95° F. with an average of 88° F. There was no aeration but the velocity was 0.67 ft. per second.

Test 2.—Specimens exposed for 414 days in a reflux water separator where the water layer contained some HCl and H_2S. Average temperature was 120° F.

The rate of corrosion exhibited by mild steel in Test 1 is much higher than the rate reported of about 0.015 in. per year which, incidentally, does not appear to be intolerable. The results from Test 2 appears to be more in line with the problem conditions and it should be pointed out that if something better than mild steel is required for the 10 by 30-ft. accumulator in question that Monel or nickel in the form of lining or clad on steel be used.

While the chromium-containing materials including Inconel and Types 302, 410, and 502 stainless steel also showed usefully low corrosion rates they were subject to pitting attack and in view of their known tendency in this respect when used in contact with halogen salts or solutions, we would hesitate to suggest their use in the problem application.

TABLE 6—TEST RESULTS, PROBLEM 8

Material—	Indicated corrosion rate-inch penetration per year	
	Test 1	Test 2
Monel	0.0015	0.0019
Nickel	0.0023	0.0023
Inconel	0.0004	*0.0002
Type 302 S.S.	0.0005	†0.0001
70-30 Cu-Ni	0.011	
Mild steel	0.056	0.018
Type 410 S.S.		‡0.0009
Type 502 S.S.		§0.0061

*Pitted to a maximum depth of 0.003 in. during test period. †Pitted to a maximum depth of 0.015 in. during test period. ‡Pitted to a maximum depth of 0.010 in. during test period. §Pitted to a maximum depth of 0.018 in. during test period.

Problem 9. Tower, Condenser and Drum Lining

Material used.—Carbon steel for tower top, 70-30 for condensed tubes, Monel for condensate drum lining, carbon steel for transfer lines and for rundown tank. It is reported that general corrosion and pitting of some of the materials is occurring but life seems to be indefinite.

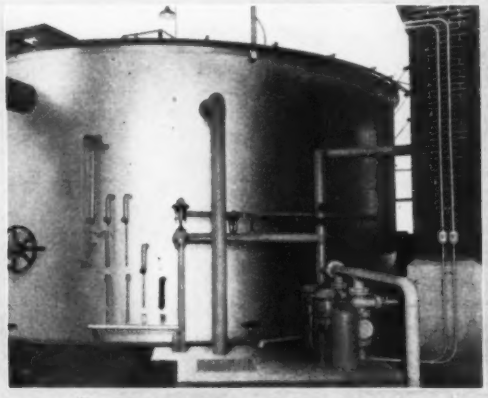
Service conditions.—Mixture of light naphtha and water bearing H_2S and some HCl with pH controlled to 6.5 to 7.5 by addition of anhydrous ammonia. Temperature: 80°-110° F., average 95° F. Operating pressure: 10 psi. Aeration: Moderate. Agitation: Turbulent in lines—quiet in drums.

Discussion.—While some slight general corrosion and pitting are being encountered with the various materials in this service, it does not appear based on plant corrosion tests that their lives will be premature. As an example, tests made in the water settling section at the bottom of the gas separator taking the overhead from a rerun tower handling gasoline and water from crude naphtha from Oficina (50 per cent), Louden (38.3 per cent), and Mid-Continent (11.7 per cent) crude oils show negligible corrosion rates for the materials in question. The test was run for 194 days at a temperature varying between 70°-112° F. with an average of 98° F.

TABLE 7—TEST RESULTS, PROBLEM 9

Material—	Indicated corrosion rate-inch penetration per year
Monel	0.0008
Nickel	0.0007
Inconel	*0.0001
70-30 Cu-Ni	0.0031
Types 302 and 304 S.S.	0.0001
Type 316 S.S.	0.0001
Type 410 S.S.	†0.0005
Type 502 S.S.	0.0043
Type I Ni-Resist	0.0020
Mild steel	0.0090
Cast iron	0.0078

*Pitted to a maximum depth of 0.004 in. during test period. †Pitted to a maximum depth of 0.006 in. during test period.



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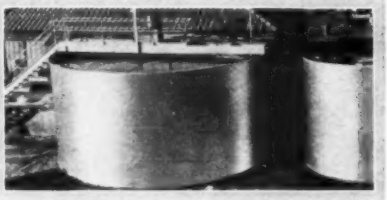

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It is evident that mild steel has a reasonably useful corrosion rate while Monel and 70-31 Cu-Ni are highly resistant to corrosion. It was indicated in the report of the problem that steel has a life of 10 years while that of Monel and 70-30 is indefinite. The data would seem to bear this out and what little pitting has been observed in practice is probably not of the serious and penetrating type that leads to untimely failure.

Problem 10. Furnace Stack

Materials used.—Carbon steel, ½ in. thick used for stack on process furnace employed in the fractional distillation of naphtha. In 10 months corrosion had destroyed the metal at one point near the base completely around the stack. Repairs were made to stack by welding 6-in. I-beams as stiffeners around the base plus an interior lining over the corroded area. In another 12 months repairs were again made as corrosion had attacked the weld metal on the interior of the stack.

Service conditions.—Flue gas containing a high content of SO_2 and SO_3. Temperature: 60° F. at base of stack to 500° F. Operating pressure: Atmospheric. Aeration: Complete. Agitation: Turbulent.

Discussion. — Temperature at the base of the stack is below the dew point of the gas and as a result some sulfurous acid if formed which is oxidizing in nature and highly corrosion to carbon steel. The results of a corrosion test made under sulfurous acid conditions at atmospheric temperature are given in Table 8.

TABLE 8

Material—	Indicated corrosion rate-inch penetration per year
Monel	*0.006
Nickel	*0.007
Inconel	*0.0025
Type 302 S.S.	†0.0001
Type 304 S.S.	†0.0002
Type 316 S.S.	0.0001
Mild steel	0.011

*Specimens, originally 0.031 in. thick, were perforated during test period. †Specimens of these materials were pitted to a maximum depth of 0.012 in. during test period.

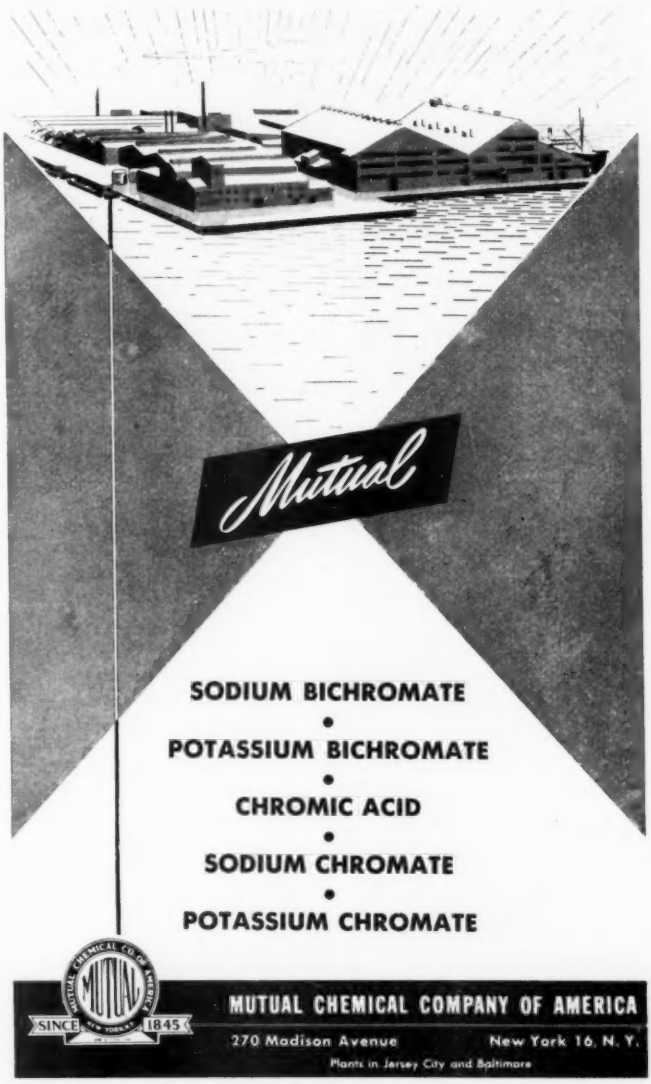
While in this test the corrosion rate of mild steel is not very high, nevertheless, it has been observed to corrode at a more rapid rate under similar circumstances. Type 316 S.S. proved to be the best of the materials tested and from a practical standpoint it has worked out to be one of the most suitable alloys that may be used in contact with dilute sulfurous acid solutions. Almost without exception Monel, nickel, Inconel, and the straight 18-8 types of stainless steel suffer localized attack in the form of pitting in this type of service.

Problem 11. Fractionation Equipment

Material used.—Carbon-steel tower, lines, and pump used in the fractional distillation of naphtha. General corrosion and pitting of steel occurs particularly at the liquid level in the tower and in pump casings. It is reported that the bottom of the tower was lined with stainless steel about a year ago and the impeller in one pump was replaced with 4-6 per cent chrome steel.

Service conditions. — Hot cracked naphtha containing H_2S with traces of water. Temperature: 600°-625° F Operating pressure: 100 psi. Aeration: None. Agitation: Turbulent.

Discussion.—Here again, the corrosive conditions must be considered to be similar to Problem 1. As mentioned previously cracked naphtha has not proved to be active in promoting corrosion of metal and alloys and, therefore, our concern lies with the effect of sulfur or sulfur compounds at elevated temperatures on materials of construction. It was shown in the tests listed under Problem 1 that mild steel can be subject to high rates of general attack as well as severe pitting in contact with with naphtha and/or gas oil containing organic sulfides and traces of



water at temperatures between 290° and 690° F.

The available data indicate that the use of 18-8 stainless steel was a wide choice for the lining of the bottom section of the tower where maximum corrosion was encountered with mild steel. It is further indicated that the substitution of Type 502 stainless steel for the impeller is a move in the right direction and it would seem practical to consider using this material for the pump casings as well. Of course, if somewhat better service life is desired over the expected performance of the Type 502 alloy, without going all the way to the use of the austenitic stainless steels, Type 410 should be considered since the corrosion test results indicate a definite superiority of about 10 to 1.

Problem 12. Vacuum Distillation Equipment

Material used.—Carbon steel used for vacuum tower, overhead vapor line and vacuum condensate transfer line in the fractional distillation of crude oil. Steel suffers general corrosion and pitting. Vitric acidproof cement is used as a lining in the tower but it breaks up exposing the underlying steel to corrosion. The shell from Tray 7 to 16 is very close to the limiting thickness and Type 347 stainless steel has been applied as a lining at Trays 10 and 11. About five of the remaining sections will be in need of relining either with vitric acidproof cement or with stainless steel in the very near future.

Service conditions.—Gas oil mixed with water containing H_2S plus some chlorides at a pH of 2.0 to 5.0 Temperature: 70°-100° F. (average 80° F.). Operating pressure: Atmospheric. Aeration: Moderate. Agitation: Turbulent.

Discussion.—Acidity of the gas oil-water mixture is in all probability due to hydrolysis of the chlorides that are present with the formation of small amounts of hydrochloric acid. Corrosion by such conditions was discussed under Problem 8 and data were presented to show the effects of this mineral acid on the performance of various metals and alloys in a rerun gasoline condensate accumulator where the pH of the water layer varied between 2.1 and 6.5 and in a reflux water separator where acid conditions also prevailed.

It was shown in these tests that steel can suffer relatively high rates of attack and that there are other materials available that are better suited for the application, namely Monel and nickel. These materials have proved to be outstanding in their resistance to corrosion by dilute solutions of hydrochloric acid and the best practical example that may be cited of the use of Monel, in particular, in petroleum refineries is for the lining of the top sections of crude oil fractionating towers where temperatures below 500° F. are encountered and corrosion by hydrochloric acid conditions must be provided against.

Neither the austenitic stainless steels nor the straight chromium varieties are employed in this service because of their generally known and proven susceptibility toward pitting attack and the test data from the reflux water separator bear this out quantitatively by the pitting measurements that have been made on specimens of these materials after an exposure of 414 days.

Based on the evidence at hand and practical experience, it would seem more logical to consider the use of Monel or nickel instead of Type 347 stainless steel for relining the remaining five sections of the tower and also for overhead vapor lines and vacuum condensate transfer lines.

Problem 13. Debutanizer Equipment

Material used.—Carbon steel used for debutanizing tower top, overhead lines, fittings and reflux condensate drum. In 1949 corrosion in the top head of the tower caused a metal loss of 1/32 in. per year and in the

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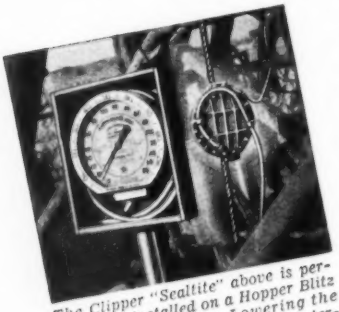

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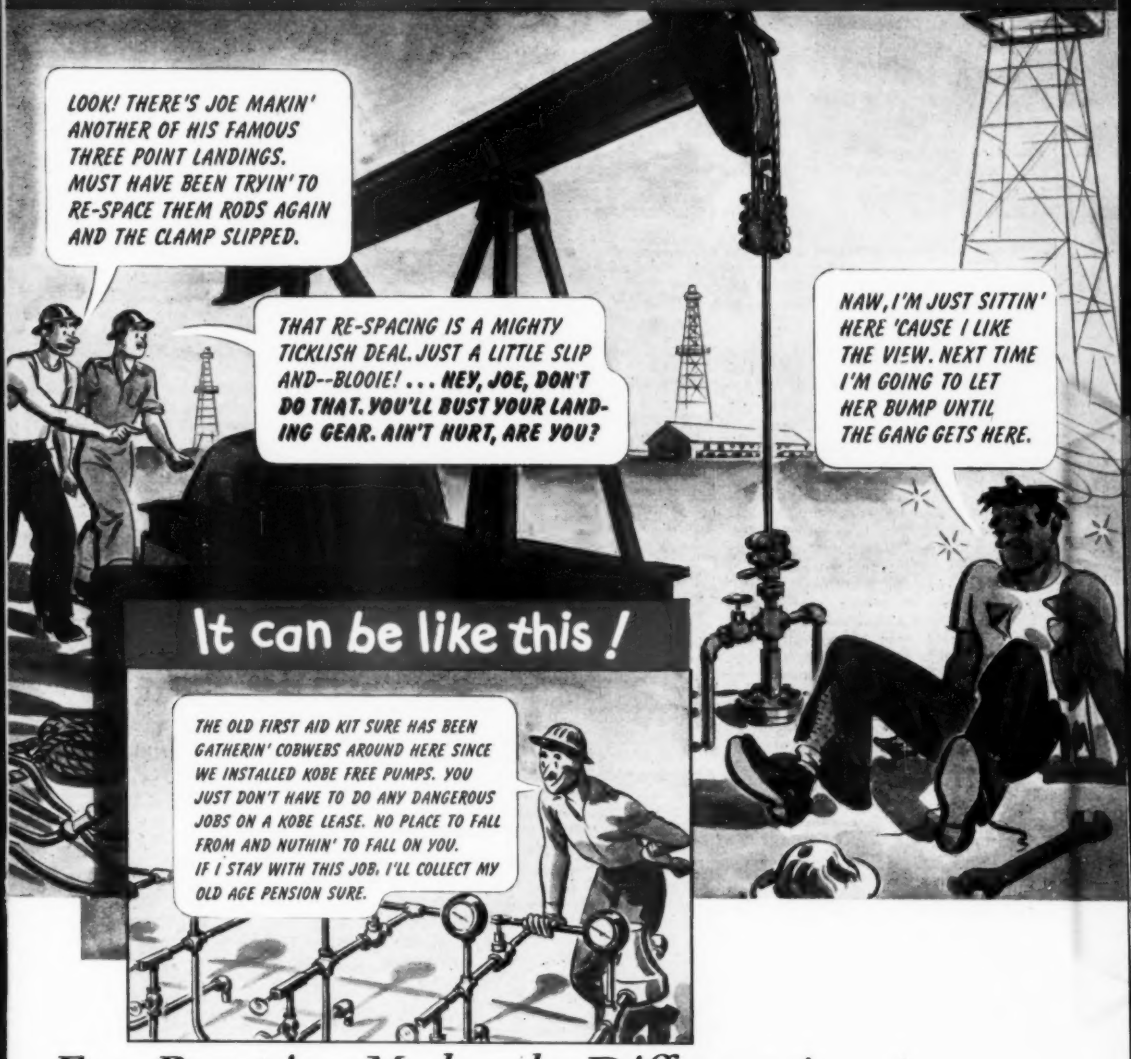
LOOK! THERE'S JOE MAKIN' ANOTHER OF HIS FAMOUS THREE POINT LANDINGS. MUST HAVE BEEN TRYIN' TO RE-SPACE THEM RODS AGAIN AND THE CLAMP SLIPPED.
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NAW, I'M JUST SITTIN' HERE 'CAUSE I LIKE THE VIEW. NEXT TIME I'M GOING TO LET HER BUMP UNTIL THE GANG GETS HERE.

It can be like this!

THE OLD FIRST AID KIT SURE HAS BEEN GATHERIN' COBWEBS AROUND HERE SINCE WE INSTALLED KOBE FREE PUMPS. YOU JUST DON'T HAVE TO DO ANY DANGEROUS JOBS ON A KOBE LEASE. NO PLACE TO FALL FROM AND NUTHIN' TO FALL ON YOU. IF I STAY WITH THIS JOB, I'LL COLLECT MY OLD AGE PENSION SURE.

..Free Pumping Makes the Difference!

Greater safety is another big plus value you get with Kobe Free Pumping. Workers don't face any of the dozens of accident hazards common to other pumping systems which have exposed moving parts and require heavy tools and equipment to install and maintain.

Management, too, saves all along the line in freedom from needless shutdowns, delays, and lost man hours.

There simply aren't any dangerous jobs around a Kobe equipped lease. All moving parts are completely enclosed even on the Triplex unit, source of Kobe hydraulic power.

Add already established savings of from 20% to 50% in both operation and original equipment costs, and it's easy to understand why the swing is so definitely to Hydraulic Free Pumping—why the rate of Kobe installations has more than doubled over the previous year.

Get the facts, and you'll join the thousands who have proved to the world Kobe is *your best pump buy*. A Kobe representative is as near as your phone.

Free Pump
KOBE
ONE OF THE DRESSER INDUSTRIES

KOBE INC. Division of Dresser Equipment Co. *General Offices:* Huntington Park, California. *Division* and *District Offices:* Avenal, Bakersfield, Huntington Park and Ventura, California; Great Bend, Kansas; Hobbs, New Mexico; Healdton, Oklahoma City, Tulsa, Oklahoma; Brownfield, Corpus Christi, Fort Worth, Houston, Kilgore, Odessa, Snyder, Texas; Casper, Wyoming; New York City.

shell from 1/64 to 3/64 in. per year. More recently there appears to be considerable increase of corrosion over that of previous years. The metal loss in the top head of the reflux drum was 1/32 in. per year and in the shell and bottom head 1/64 in. per year. It was also reported that the debutanizer tower overhead and reflux lines both show a corrosion rate of 1/64 in. per year.

Service conditions.—Light naphtha mixed with water containing H_2S and some HCl at a pH of 2.0 to 5.0. Temperature: 250° F. at top of tower, 70° F. in reflux drum. Operating pressure: 60 psi. Aeration: None. Agitation: Turbulent.

Discussion. — This problem should be considered along with Problems 8 and 12 wherein corrosion by hydrochloric acid, the most active constituent in the mixture, is the principal cause of the deterioration of the steel equipment. As mentioned previously, it is not generally good practice to use the austenitic stainless steels or the straight chromium types under such conditions because of pitting tendencies. This holds especially at the top of the debutanizer tower where the maximum temperature is 250° F. since it would be expected that the localized attack would be seriously increased. Under the circumstances, therefore, it would be suggested that Monel or nickel be considered for the service in question especially since they have proved over the years to be most suitable and practical materials to use in somewhat similar or comparable applications.

Problem 14. Regenerating Tower

Material used.—Steel regenerating tower used in a furfural-recovery system.

Service conditions. — Furfural and water at 360° F. Severe corrosion of mild steel above the vapor line at each tray level in less than a year's time rendered the tower useless and required the installation of a lining.

Discussion.—Under some conditions it has been found that the decomposition products of furfural at elevated temperatures can be highly corrosive to steel and the following data obtained in a furfural extract separation tower tend to verify this experience. Specimens were exposed for 122 days in the downpour between the bubble trays in the tower where the temperature of the furfural averaged 450° F. There was no aeration but some agitation was reported due to flow of the extract.

The data indicate that chemical lead, mild steel, and Type 410 stainless steel are apparently unsuitable for use under the particular test conditions because of their tendency to suffer severe localized corrosion. All of the other materials investigated showed an absence of this form of

TABLE 10—TEST RESULTS, PROBLEM 14

Material—	Indicated corrosion rate-inch penetration per year	Maximum pitting during test (in.)
Monel	0.0001	None
Nickel	0.0001	None
Inconel	0.0001	None
Type 302 stainless steel	0.0001	None
Type 316 stainless steel	0.0001	None
Chemical lead	0.0026	Perf.*
Type 410	0.0014	0.012
Aluminum 2S	0.0002	None
Type 502 stainless steel	0.0001	None
Mild steel	0.0112	Perf.*
Ni-Resist	0.0001	None
Cast iron	0.0001	None

*Specimens of these materials were originally 0.062 in. thick.

corrosion and at the same time showed negligibly low rates of general attack. Under the circumstances, therefore, it would appear practical to select one of these as a lining material to protect the steel tower in question which is doomed to premature failure.

The author has had some firsthand experience with a Monel-lined furfural-treating tower equipped with Monel internals and a recent checkup on this installation indicates that it is still in satisfactory condition after better than 12 years' service.

Problem 15. Fractionating Tower

Material used. — Steel straightrun fractionating tower and trays. The trays were $^3/_8$ in. thick and lasted only a year and the shell was severely pitted after 2 years. The severest condition occurred in the uppermost section of the tower.

Service conditions.—Crude oil being processed with a gravity of 20 to 26. The sulfur content varied from 1.3 to 2.5 and the salt content from 15 to 30 lb. per 1,000 bbl. The total sulfur in the gasoline varied from 0.12 to 0.40 per cent. The temperature at the top of the tower was maintained at 300° to 340° F. and 18 per cent gasoline was being produced.

Discussion.—Corrosion in the top sections of atmospheric crude distillation units arises chiefly from hydrochloric acid either formed by hydrolysis of chloride salts, especially calcium and magnesium chloride, entrained in the crudes, or added by the acidizing of wells. Despite the customary practice of settling the salt water from crudes, and in some cases the use of special desalting processes, there still appears to be enough salt water dispersed in such crudes to result in the formation of an acid condition.

Corrosion is mitigated in some cases by injection of ammonia into the distillation system to neutralize part of the acid, but experience would indicate that this frequently is not an adequate solution to the problem.

It is probable that with salty charging stocks, maximum hydrolysis of magnesium and calcium chlorides occurs in the hottest region at the bottom of distillation towers; however, maximum acid corrosion occurs in the top portion of such towers, in reflux and distillate condensers, coolers and accumulators, and in reflux and rundown lines, where temperatures are low enough for an aqueous acid phase to condense. Maximum corrosion by sulfur compounds will, on the other hand, occur in the higher-temperature ranges in the bottom portions of distillation towers and in crude heaters.

As the alloys most resistant to acid corrosion frequently are not resistant to high-temperature sulfur attack, it is common practice to line the top and bottom portions of distillation towers with different materials to obtain most favorable performance.

Numerous corrosion tests have been made on or above the top of atmospheric crude-distillation towers in a number of refineries in different geographical locations and the following results are typical of those representing probably some of the worst conditions involving the processing of West Texas crude. The specimens were exposed for 60 days to the straightrun gasoline vapor at the top of the tower maintained at an average temperature of 250° F.

TABLE 11—TEST RESULTS, PROBLEM 15

Material—	Indicated corrosion rate-inch penetration per year	Maximum pitting during test (in.)
Monel	0.0031	None
Nickel	0.0057	0.013
Inconel	0.017	0.016
Type 302 stainless steel	(*)	
Type 304 stainless steel	(*)	
Type 316 stainless steel	0.053	0.001
5 per cent nickel steel (S.A.E. 2512)	(*)	
Mild steel	(*)	
Ni-Resist	0.051	None
Cast iron	0.181	Graphitized

*Specimens of Types 302 and 304 stainless steel and 5 per cent nickel steel, originally 0.031 in. thick, and mild steel, 0.062 in. thick, were completely destroyed during test period.

The test data indicate that mild steel as well as the 18-8 types of stainless steel, 5 per cent nickel steel and cast iron is definitely unsuitable under these conditions. It is apparent also that nickel and Inconel are not adequate because of their susceptibility to severe pitting attack. The Type 316 stainless steel showed a reasonable corrosion rate and while the depth of local attack was rather insignificant, this tendency nevertheless exists and it has been noted to be much more serious under similar circumstances.

Of the remaining materials, Monel proved to be outstanding from the standpoint of resistance to both general corrosion and pitting.

CORROSION and its control

Minimum Cost Protection for Secondary Lines

THROUGHOUT the oil industry and elsewhere there are many miles of piping whose economic status is such that no great expenditure for corrosion control can be justified. In order to be classified as "secondary piping" a line must have two characteristics: (1) it must be earning such low returns that the loss of operating time due to leaks is not great; and (2) it must be so situated that the potential damages resulting from a leak will be small. Many gathering lines, operating intermittently and at low pressures, and lying across undeveloped or underdeveloped land, meet both of these requirements. Leaks on such lines are not costly, nor is their repair expensive. Yet they must be repaired, and any low-cost program which will diminish their number will represent a profitable investment.

Determine Where Protection Needed

The first requirement is a simple method of determining the locations where protection is needed. The simplest possible method, and at the same time the most reliable, is that of applying protection wherever leaks occur. There can be no better criterion of corrosiveness in a soil than the occurrence of leaks. Accordingly, for a minimum cost program, the protection should be applied at those points demonstrated to be corrosive.

The next essential is the least expensive type of protection which can be installed, and the least expensive system for installing it. The only kind of cathodic protection which can be installed in small and scattered units is that afforded by magnesium anodes; and for low-cost installation the packaged anode offers advantages of simplicity and ease of handling as compared with the mixing of backfill for bare anodes. The time to install is at the time of repairing the leak. The crew is at hand; the equipment is there. The additional time and labor required for the installation of one or two anodes are small, and the cost of the anodes themselves is not great.

Since these anodes are to be installed without benefit of an engineering survey, and therefore no means is at hand for the determination of the most effective size to be used, the simplest procedure to follow is the adoption of a standard anode for all locations—and for this purpose the 16 or 17-lb. anode is most generally adapted.

Anodes should be placed from 6 to 10 ft. away from the pipe, and from 6 to 8 ft. deep. Where the pipe is very deep, it may sometimes involve less work to set the anode 8 to 10 ft. deeper than the pipe, boring the anode hole alongside the line in the same ditch. After the anode has been placed and wet down thoroughly, a reading of the current should be taken before the actual connection to the pipe is made. From this reading it will be possible to make a rough estimate of the probable life of the anode, using the approximation

$$T\,C = 1200,$$

where
T = estimated life in years,
C = initial current output in milamperes

Thus an anode whose initial current output is 200 ma., will have a projected life of about 6 years.

The number of anodes to be installed at a given location should be based on the size of the line, the length of pipe considered to be included in the "hot spot," and the current output observed from the first anode installed. The following spacing is suggested for various sizes of pipe:

Pipe (in.)	Ft.
2—one 16 (or 17-lb.) anode ever	40
3—one 16 (or 17-lb.) anode every	30
4—one 16 (or 17-lb.) anode every	25
6—one 16 (or 17-lb.) anode ever	16
8—one 16 (or 17-lb.) anode ever	10

It is suggested that at each leak site, one more anode be installed than is indicated by the above spacing. When the current is read for the first anode, the number of anodes to be installed should then be modified by the following set of rules:

1. If the current is less than 60 ma., decrease the number of anodes to one-half.

2. If the current is more than 300 ma., double the number of anodes (they may even be installed two in a single hole).

The attachment to the pipe should be made by welding, brazing, or soldering. A convenient method is the Cadweld (thermite) process.

Importance of Complete Records

It is of utmost importance that complete records be kept of size and location of all anodes installed under this program, and that the locations be marked if this is at all possible. Such records will prove of great assistance if, as is very often the case, conditions later warrant an engineering study of the line and the design of a fully effective system.

It should be strongly emphasized that the above described system represents a low-cost program; it cannot be expected to compare in overall effectiveness with a properly engineered system; many anodes will be installed which are working at a small part of their possible accomplishment. However, such a program may well be all that can be justified on a line which has the two characteristics listed earlier. Any line which represents a very large investment, or which is earning a considerable amount of revenue, or which is situated so that a leak might cause expensive damage, deserves and should receive more careful (and more expensive) protection than the minimum which has here been described.

Part 32 of a series by Marshall E. Parker, consulting engineer, Houston.

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DRAW WORKS
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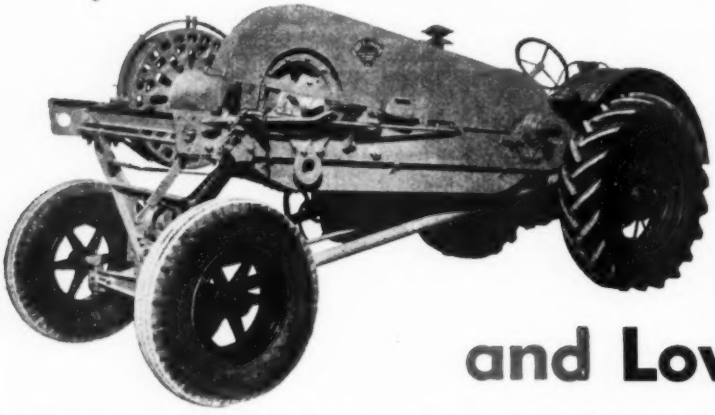
POWER UNITS

Model M-318 Tractor Winches



for SERVICING to 4,000'

FAST RUGGED and Lowest Cost

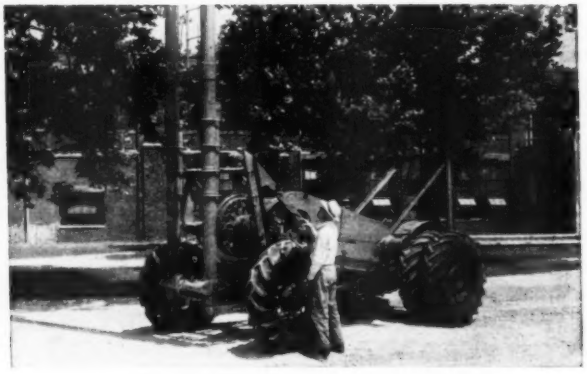
Brakes—
Two—32" dia. x 6" wide
Drum Capacity—
4800' of ⅝" line
Line Speeds—
8 from 38" to 1030' p.m.
Maximum Line Pull—
30,300 lbs. @ 38' p.m.
Road Speeds optional—
15 m.p.h. or 30 m.p.h.

ONLY *ONE* PIECE OF EQUIPMENT TO BUY AND MAINTAIN . . . takes itself to the well, no extra investment or maintenance on a truck.

COOPER—ALLIS-CHALMERS

The Model M-318 Tractor is compactly designed and balanced for high speeds on the road and at the well. Will go over ground conditions that are impassable or extremely difficult for other types of pulling equipment. Powered by an ALLIS-CHALMERS heavy duty, valve-in-head, removable sleeve type engine with ample cooling capacity for continuous stationary operations; incorporating large capacity brake drums, and a heavy duty tractor type transmission without the use of auxiliary power-take-off, make this unit exceptionally safe and efficient.

The Model M-318 is the best buy on the market, for its capacity. Many of these sturdy units have been in continuous service for more than 16 years. Built with Single Drum or Double Drums. Additional Equipment: Large mud front tires and dual rear tires; Single or Double Pole Telescoping Masts; Spudding Equipment for Clean-out, Rotary Drive, and Metal Cab.



M318-32 Single Drum Tractor Winch with 2-pole 60' Mast. Equipped with air controls and six mud tires. Note easy position of operator.

Other COOPER — ALLIS-CHALMERS Tractor Winches:

Model W-201	for Servicing to		3000'
Model E-563	"	"	5000'
Model L-844	"	"	10000'

Let us furnish you complete details. Better still, see for yourself how our units are proving to be "money makers" on the job.

Regardless of the depth of wells, there is a COOPER—ALLIS-CHALMERS Winch of the right capacity to do the job economically.

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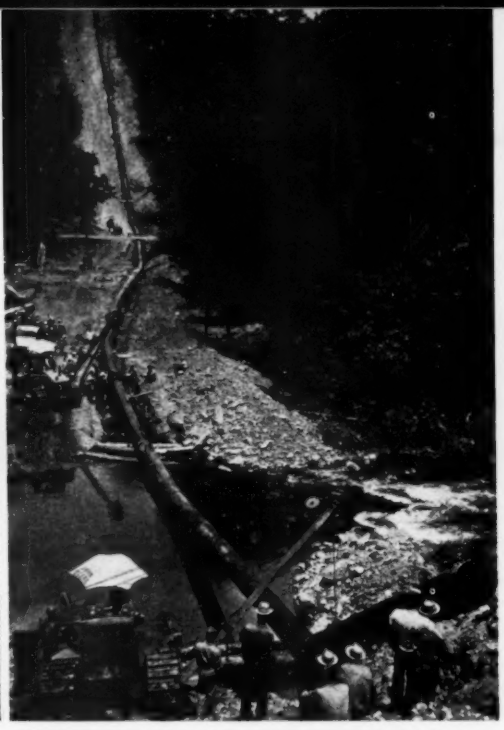
Western Canada: Rocky Mountain Supply Co., Ltd., Calgary, Edmonton, Redwater

"BIGGEST INCH."—One of the outstanding pipe-line-construction feats by H. C. Price Co. was the laying of the 30-in. "Biggest Inch" for Southern California and Southern Counties Gas companies.



"TOUGHEST INCH."—The Price company successfully laid the 26-in. "Toughest Inch" for Columbia Gas System, Inc., over some of the most inaccessible terrain ever encountered by a pipe-line crew.

H. C. PRICE CO. MARKS 30th ANNIVERSARY

Three decades ago this firm started out on borrowed money as pioneers in electric welding. Today it is one of the leaders in pipe-line construction, claiming many "firsts" in advancing laying techniques.

by William P. Sterne

NOBODY ever thought of using electric welding on a pipe line when H. C. Price opened a little welding shop in Bartlesville, Okla., 30 years ago.

Price didn't think of it either, at that time, though he had great faith in the future of the then-infant business of welding metal with an electric arc.

It was this faith and Price's continual improvements in the electric-welding process that eventually displaced acetylene welding from the pipe-line field and helped build H. C. Price Co. into one of this country's major pipe-line-construction companies.

The company will observe its thirtieth anniversary on November 1.

Pipe lining was not in his plans when Hal Price opened Electra Welding Co. in Bartlesville in 1921, with two helpers and one machine purchased on borrowed money. A graduate of Colorado School of Mines, Price was impressed with the possibilities of electric welding, but at that time its use was confined to shop work.

It was leaking lease tanks that took Price and his welding machines out of the shop and into the oil fields.

First forward step.—Price recalls that in the fall of 1922 his firm was given the job of repairing the bottom of a 55,000-bbl. tank for Empire Pipeline Co. in El Dorado, Kans., field.

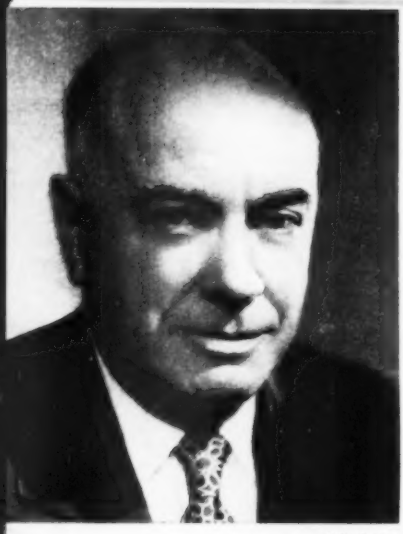
"We felt sure that electric welding would be cheaper and more satisfactory," he relates. The tank leaked badly and it required 11,000 lb. of rod to weld the 2,867 ft. of seams and 22,936 rivets. The crew also plugged all rivet holes and built up worn and pitted spots with welded patches.

"The job was successful and, as far as we know, this was the first tank bottom to be repaired by electric welding," Price said. "The tank job was also a success financially, so we closed up shop after 1 year's operation, and started contracting tank welding in the field." He also changed the firm's name to Welding Engineering Co.

Right From the Start

As news of the company's El Dorado experience became known, there was a growing demand for its services in electric welding storage tanks.

A tank-roof welding job usually took 5 to 6 days, but Price set one speed record on the roof of an 80,000-bb. tank for Empire at Oklahoma



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H. C. PRICE
President, H. C. Price Co.

City. This rush job, with 14 welders working, took only 20 hours.

From then on business prospects brightened. More and more companies became interested in the Price method of tank welding. During 1923-24 the firm completed 45 roofs and bottoms, and by 1926 contracts had jumped to 106. In the Gulf Coast, Texas Panhandle, North Texas, Kansas, Oklahoma, and Ohio, Price crews were kept busy welding new roofs and bottoms as well as repairing old and leaky tanks. Price had become the largest electric-welding contractor in the Mid-Continent.

Only a year after opening his own business Price did his first experimenting with pipe-line welding, but without much success. Price recalls:

"We welded 12 joints and tested them under 300 lb. of cold-water pressure. Every joint leaked; some more than others, but none of the joints broke, all the leaks being through pin holes. It looked like a sprinkling system."

This job was in 1922, and shop welders were used on the work, which included 150 joints of 12-in. pipe for Empire Gas & Fuel Co. at Caney, Kans. It was the first time that anyone had ever used electric welding on field pipe lines.

"But we still had great faith in electric welding," Price relates. "It operated satisfactorily in our shop and as agents for the electric-welding machines we had sold a number of them with satisfactory results. From this first field job we concluded that we must develop experienced men for this type of work—men with more practice in field welding."

Price was also convinced that there was a great future for any company that could successfully electric weld oil and gas pipe lines under field conditions.

"We turned our attention to welding oil-field-storage tanks," Price reports. "It was 6 years before we attempted another pipe-line welding job."

The turning point in the firm's history came in 1928, with its first contract for field welding a pipe line by the electric method.

Successful Pipe Line

Price landed the contract, in 1928, for field welding of Texas Pipe Line Co.'s first major electric-welded pipe line—a 169-mile line from San Antonio to Corsicana, Tex. The art of electric welding had advanced greatly during the 7 years that Price had been in business. Some electric welding had been done on shorter lines, but the proposed long oil pipe line for Texas Pipe Line was to be the first real test of this method.

"Our equipment," Price relates, "consisted of 18 welding machines mounted on farm wagons drawn by horses or mules. Roller-bearing welding dollies were unheard of, and we often used tree limbs for skids. We would put grease on the skids and roll the pipe against a cleat. Bare welding rod was used, as coated rod was not yet available."

Welding was performed by two

BIG DITCHER.—This big ditcher was one of many used by the Price company in trenching for the "Biggest Inch," for Southern California and Southern Counties Gas companies.

Here are the spread superintendents who ride herd on getting pipe laid

G. A. REUTZEL
Supt., Spread 1

R. K. SHIVEL
Supt., Spread 2

C. E. SHIVEL
Supt., Spread 3

C. R. ICE
Supt., Spread 4

gangs, on a piece-rate basis with a minimum guarantee. Firing-line welders were guaranteed $1 an hour for 10 hours plus 40 cents for each weld over 20. Bell-hole welders received $1.10 an hour plus 60 cents for each weld over 12.

The job totaled 20,881 welds and was completed in 4 months. Although the men were slow at first, as the crews became better organized the line went forward rapidly and welders averaged as many as 25 welds a day. Bell-hole welders averaged 15 welds daily, with one gang reaching an average of 20.

As the work progressed, advantages of electric welding became apparent. Machines proved unusually adaptable in broken country; in swamps and canyons the company could use extra-long cables, eliminating need for moving heavy equipment along the right-of-way.

After that pioneering job, Price introduced many improvements in the technique of welding and laying pipe. For many years, Welding Engineering Co. contracted over 75 per cent of all the electric-welded pipe lines in the country.

Firsts.—Among the initial accomplishments of the Price organization were: First to repair a large oil-field-tank bottom by electric welding; first to repair a large oil-field-tank shell by electric welding; first to electric weld floating roof for oil-field-storage tanks; first to electric weld a breather roof on oil-field-storage tanks; first to electric weld a large-diameter solid-welded gas line without couplings; first to electric weld a pipe line without use of a back-up ring; and first to use an internal line-up clamp on pipe-line construction.

In 1933 the company successfully completed the first line to be electric welded with plain-end pipe, without use of back-up rings. It contributed immeasurably to the use of coated rods in electric welding of pipe lines, and further developed the "stovepipe" method of welding—where the pipe remains in position over the ditch instead of being rolled.

By 1940 the firm was operating more than 200 electric-welding machines in addition to a vast array of other necessary construction equipment, including trucks and tractors. There were 500 on the pay roll.

The Shielded Arc

Back in 1929 Welding Engineering Co. had 200 men on its pay roll, which totaled $220,000 annually. During that year—the first full year as an electric-welding contractor for pipe lines, the firm bought 66 portable electric-welding machines and welded over 800 miles of line. This made Price the

(Continued on page 142))

J. B. HARSHMAN

J. B. Harshman, vice president of H. C. Price Co.'s pipe-line division, is a native of Fremont, Iowa. In 1920 he joined the old Sinclair Pipe Line Co. in Oklahoma. This firm later became Stanolind Pipe Line Co.

Starting as a pump-station engineer, Harshman spent 28 years in various capacities with Sinclair and Stanolind, rising to position of general manager of operations. He later left Stanolind Pipe Line Co. (now Service Pipe Line Co.) to join Fish Pipe Line Constructors.

A veteran of 30 years in pipe lining, he was appointed to his present post with H. C. Price in 1950.

. . . and here are some of the home-office personnel in executive and administrative positions

JOHN M. THOMAS
Pipe-line Div. Mgr.

ELMER L. GALLERY
Secretary-Treasurer

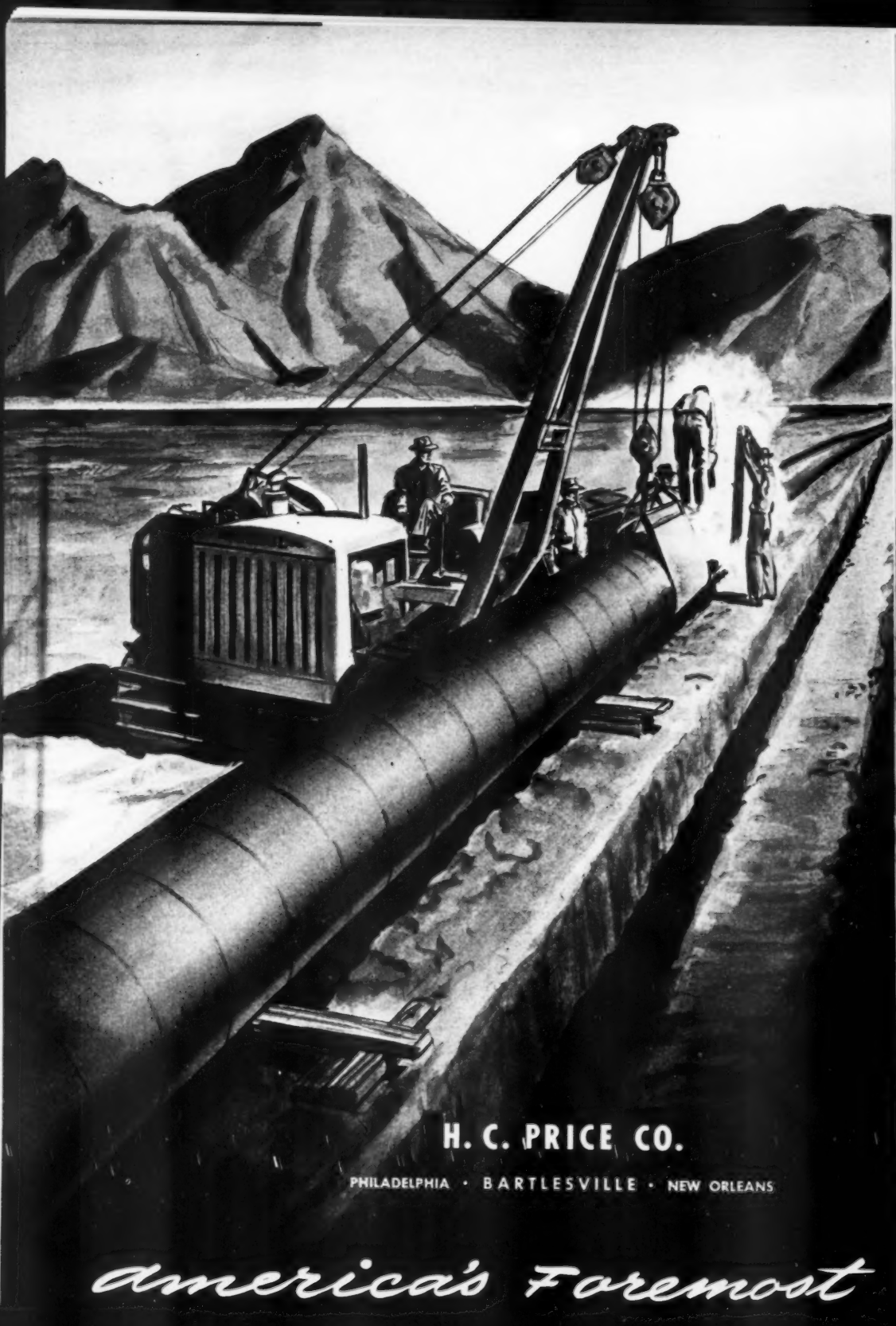
JOHN OVERTON
Asst. Secty.-Treas.

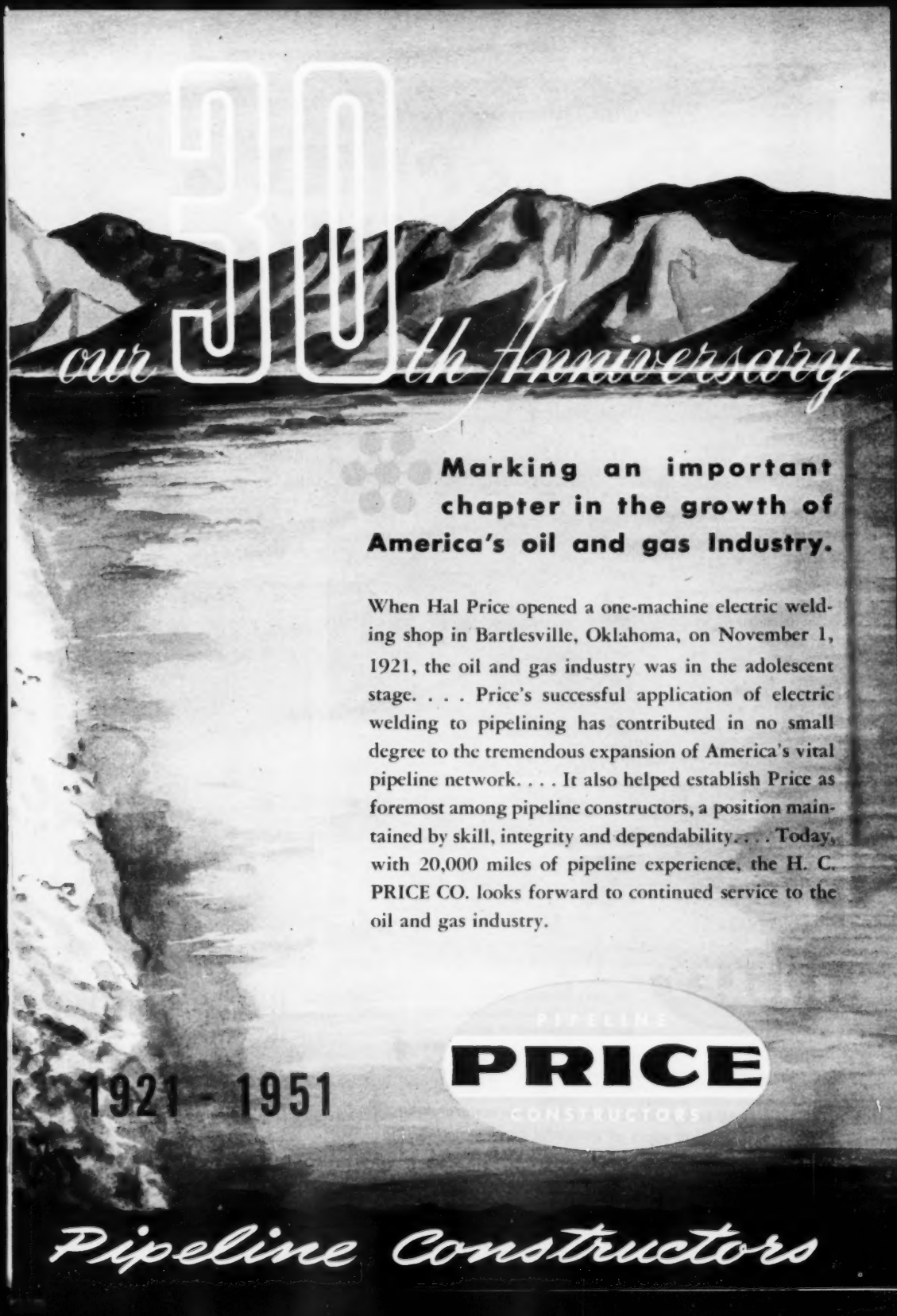
ROY E. BURGESS
Administrative Asst.

B. G. PIERCE
Safety Director

SAM PAXSON
Purchasing Agent

DAVID J. KERR
Public Relations Dir.


H. C. PRICE CO.
PHILADELPHIA · BARTLESVILLE · NEW ORLEANS
america's Foremost


30
our 30th Anniversary
Marking an important chapter in the growth of America's oil and gas Industry.
When Hal Price opened a one-machine electric welding shop in Bartlesville, Oklahoma, on November 1, 1921, the oil and gas industry was in the adolescent stage. . . . Price's successful application of electric welding to pipelining has contributed in no small degree to the tremendous expansion of America's vital pipeline network. . . . It also helped establish Price as foremost among pipeline constructors, a position maintained by skill, integrity and dependability. . . . Today, with 20,000 miles of pipeline experience, the H. C. PRICE CO. looks forward to continued service to the oil and gas industry.
1921 - 1951
PIPELINE
PRICE
CONSTRUCTORS
Pipeline Constructors

We're proud of this pipeline partnership

H. C. PRICE CO.

THE INSLEY HILL-BILLY

For many years, HCPCO has included Insley equipment as an important part of its spread machinery. This pipeline pioneer has participated in many notable accomplishments in the history of this industry—an industry that demands the best of *men* and *equipment*.

The "Toughest Inch"

The Insley Hill-Billy, shown at work on the "Toughest Inch" in the West Virginia mountains, is built to conform with the specific requirements of short-cut routes in modern pipeline construction.

INSLEY MFG. CORP.
INDIANAPOLIS 6, IND.

All Insley distributors join me in congratulating the H. C. Price organization on thirty years of successful pipeline pioneering.

W. B. ELLIOTT, *President*
Insley Manufacturing Corporation

FINAL CHECK.—These joints of Somastic-coated pipe at H. C. Price Co.'s Somastic plant near Morgan City, La., are given a final check by workmen before being removed to a stockpile. Pipe has been whitewashed to facilitate cooling.

Price's Somastic Division Has Coated Pipe for Many Major Lines

AN important operation of H. C. Price Co. is its Somastic Division, which is responsible for the application of Somastic to pipe for purposes of corrosion protection, and which has recently developed a process, called "Hevicote," for adding weight to pipe.

This division, which operates two permanent coating plants—one near New Orleans and the other at Philadelphia—in addition to various rail-head plants, is licensed by Standard Oil Co. of California to apply Somastic in the 37 states east of the Rocky Mountains. Its Hevicote patents cover the entire country.

The Price company, which observes its thirtieth anniversary on November 1, has had a part in coating pipe for many major pipe lines in the United States. The Somastic coating, an asphaltic product developed by Standard of California, is enjoying increasing demand as an effective means of combating corrosion.

In addition, the Somastic-coated pipe turned out by Price's plants has been used on many foreign jobs, including a 17-mile submarine line laid in the Persian Gulf for Arabian American Oil Co. by Bechtel-McCone Corp. At that time this 17-mile line was the second longest underwater Somastic-coated line ever laid, the longest being the 24-mile, 14-in. submarine line across Lake Ponchartrain, Louisiana.

United Job

One of the largest Somastic-coating jobs undertaken by Price was a project this year for United Gas Pipe Line Co. covering a 150-mile network of pipe in Louisiana and to offshore gas wells. It was found by the pipeline company that Somastic offered the most permanent type of protection to combat the high rate of corrosion encountered in the area. Price moved a rail-head plant by barge about 80 miles to a location on Bayou Boeuf. After most of the area was filled in with sea shells, the Somastic machinery was installed in concrete foundations to insure stability in the marshy area, and provide for high-speed assembly-line techniques of coating.

After pipe was unloaded by crane from barges tied up alongside the waterfront, it was moved by truck to a stockpile and racked until its turn came for coating.

Coating Operation

Before the coating operation begins on any job, the joints must be thoroughly dried and cleaned. The cleaning activity is accomplished by running the pipe through a grit blasting machine where it is pelted by myriad steel shot that remove scale and rust from joints. The joint next receives a primer coat and is rolled off onto a rack adjoining the actual coating plant.

The Somastic process is a continuous operation, with the front of one joint being affixed to the back end of the preceding joint by means of two interlocking couplers. The thick asphaltic mix is forced through a nozzle and applied to the pipe by rotating blades.

Composition.—The mix includes approximately 63 per cent sand, 24 per cent lime, 12 per cent asphalt, and 1 per cent asbestos fiber, all of which is heated to a temperature exceeding 400° F. before its application to the pipe. In the case of 30-in. pipe, the coating is applied to a thickness of

UNITED LINE.—This long section of 30-in. pipe was Somastic coated by Price's plant near Morgan City, La., for United Gas Pipe Line Co. Dark bands are Somastic field molds which have not been whitewashed.

J. S. DEWAR

A native of Prince Edward Island, Canada, J. S. Dewar, vice president of H. C. Price Co.'s Somastic Division, started his career as a tool dresser in the Oklahoma oil fields. He later joined Barnsdall Oil Co., and in 1917 joined Phillips Petroleum Co.

Dewar became associated with H. C. Price in 1943, when he joined the company to assist in coordination of company activities, including Industrial Engineering Co. This firm was incorporated in 1936 to manufacture and distribute Somastic pipe coating, and in 1945 Dewar became president. The firm was absorbed by H. C. Price Co. in 1946, and Dewar was named vice president of the Somastic Division.

R. P. WHITE
Manager, H. C. Price Somastic Division

⅝ in. and will weigh approximately 56½ lb. per lineal foot. This aggregate adds nearly 1 ton to the weight of the steel, which for a 40-ft. joint of 30-in. approximates nearly 3 tons.

The pipe joint rests on dollies affixed to a permanent track as it moves through the plant. As it emerges from the plant bearing the hot asphalt mastic coating, it is given a bath of whitewash. This cools the pipe, and it is then removed by a crane and laid out in spokewheel fashion for further cooling for approximately 1 hour before stockpiling.

Easily handled.—The treated pipe can be handled as easily as bare pipe because the coating hardens quickly and leaves a solid coating. However, this same joint can be bent in the field to fit the contour of the ground without fear of rupture. To insure that the coating is satisfactory and without holidays, it is "jeeped" both at the plant and in the field before it is lowered into the ditch.

Welding in the field.—Each joint is left uncoated for approximately 9 in. on each end, to permit welding in the field. This bare section is then covered with a Somastic field joint, which overlaps the coating applied at the plant, and leaves an unbroken covering. About 125 lb. of coating is required for each 30-in. field joint.

Personnel.—The Somastic activities of H. C. Price Co. are headed by J. S. Dewar, vice president, and Robert P. White, manager of the division. Montie J. Lane is superintendent at Philadelphia, and T. L. Huitt is office manager. The Gulf Coast superintendent at New Orleans is Nelson Versoy, and office manager is M. E. Anderson.

WHITEWASHING.—This joint of pipe gets a bath of whitewash to speed up cooling after its Somastic application. Workmen at top are removing one of the couplers which tied this joint with the section of pipe that preceded it as it went through Somastic plant.

READY FOR STOCKPILE.—A joint of Somastic-coated pipe is loaded on an Athey wagon for transfer to a stockpile after being processed at Price's Somastic plant near Morgan City, La. Pipe coated with Somastic cools rather rapidly.

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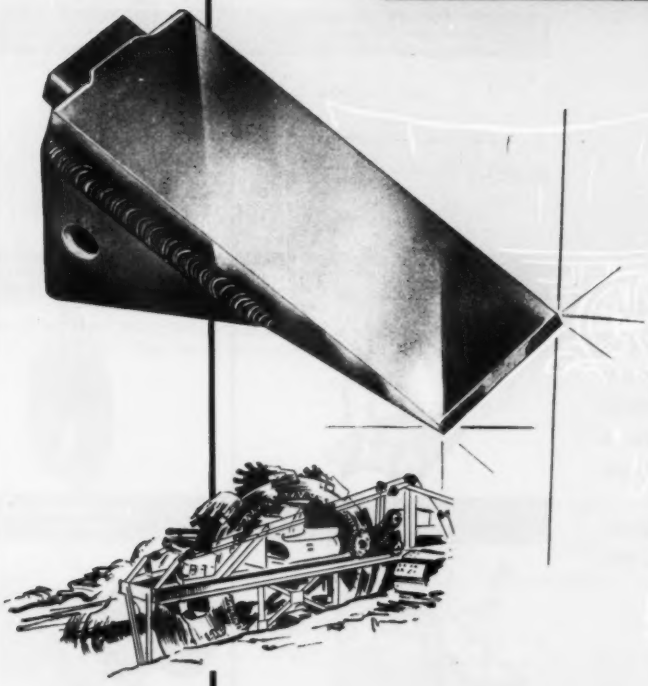

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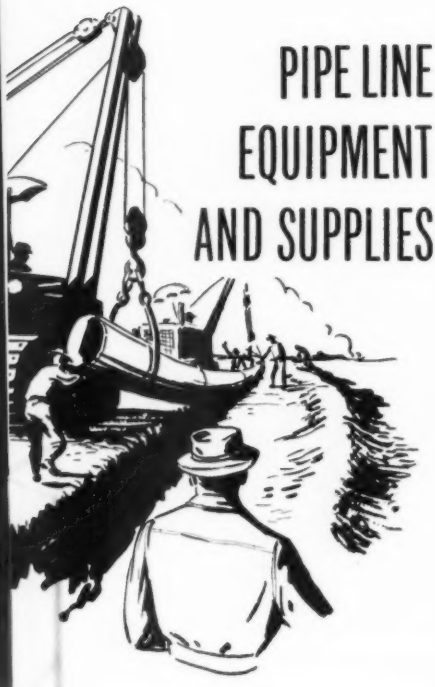

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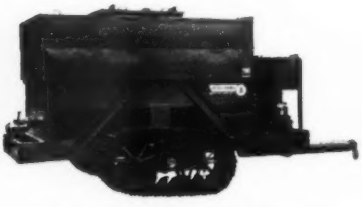

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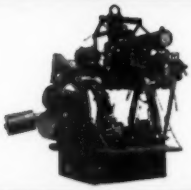

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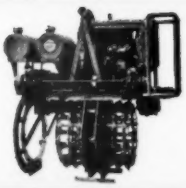

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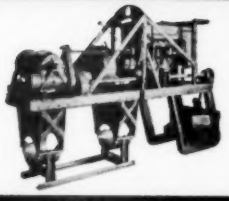

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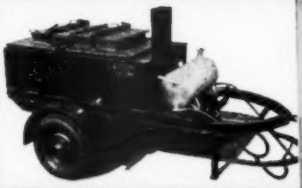

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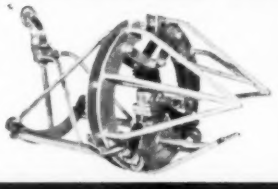

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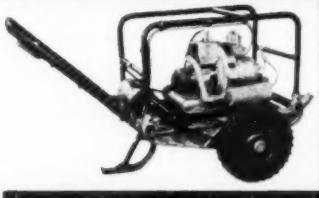

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THROUGH TEXAS' PINEY WOODS.—A group of sideboom tractors struggles to get this section of 30-in. pipe fitted into place at Texas Illinois Natural Gas Pipe Line Co.'s crossing of Piney Creek in East Texas, where caving banks kept the ditch clogged with mud.

Two Major Projects Completed in 1951

Price crews again prove their ability for handling tough jobs by successfully laying Texas Illinois section in Texas, New York extension for Tennessee Gas Transmission

TWO major pipe-line-construction projects have already been carried out this year by H. C. Price Co. These were completion of a 480-mile section across Texas for Texas Illinois Natural Gas Pipe Line Co., and a 156-mile 24-in. extension of Tennessee Gas Transmission Co.'s system from near Buffalo to the Onondaga-Madison county line in New York State.

The Price company—30 years old on November 1—is one of the country's veterans in construction of pipe lines. Known for its capabilities in handling extremely difficult assignments, its past record shows more than 20,000 miles of pipe-line experience in North and South America, as well as the Middle East.

Few indeed are the principal oil and gas pipe lines in this country that were not built in part by Price crews.

Texas Illinois Job

Texas Illinois Natural Gas Pipe Line Co. probably had this in mind when it awarded Price the contract for a major portion of its new 30-in. line to Chicago. This 480-mile Texas section of the 1,300-mile project proved to be nearly as difficult as any job ever undertaken by a pipe-line-construction firm. Torrid temperatures, treacherous river crossings, steaming swamps, ankle-deep dust, and knee-deep mud all teamed up to make the operation one of the toughest.

Price crews began work on the Texas project in the fall of 1950. Equipment was moved in, and considerable work completed before winter weather forced a 4-month shutdown. During this lapse in construction, however, equipment was overhauled and other maintenance work carried on. Construction activity was resumed in February 1951 and completed the first of September.

The Texas project was divided into the following sections:

The main 309-mile, 30-in. link, between Hungerford and Texarkana, Tex.;

98 miles of 26-in. feeder line from LaGloria field near Corpus Christi;

36 miles of 24-in. extension to Old Ocean field;

38 miles of 12-in. supply line into Chocolate Bayou near Galveston.

Spread Work

Spread work was carried out under direction of C. E. Shivel and C. R. Ice, superintendents. Shivel's spread was made up of the following crew members: D. H. Johnston, office manager; C. F. Jones and R. H. Edwards, right-of-way foremen; Ray Drewell, ditch foreman; J. V. Huff, bending foreman; E. D. Worley, pipe foreman; John Stokes, welding foreman; Henry Hill, coating foreman; Bill Buchanan, lower-in foreman; Paul McCormack, clean-up foreman; and Boyd Danner, equipment foreman.

Ice's spread was made up of: G. A. Harvey, office manager; W. O. Elliott and Jessie Cash, right-of-way fore-

T.G.T. WORK.—Welders from Price spread busy at work on section of Tennessee Gas Transmission Co.'s new 24-in. line extending eastward from Buffalo. This scene is near Warsaw, N. Y.

HIGHWAY CROSSING.—Crew works on a tie-in at a highway crossing along T.G.T.'s right-of-way near Auburn, N. Y. G. A. Reutzel, Price spread superintendent, directs work from left bank.

men; E. W. Whisenant, ditch foreman; Forest Loinette, bending foreman; W. T. Dickerson, pipe foreman; L. O. Reutzel, welding foreman; N. D. Adams, coating foreman; J. C. Rich, lower-in foreman; John E. Hamilton, clean-up foreman; and Cliff Birmingham, equipment foreman.

Big capacity.—The Texas Illinois line will have an initial delivery capacity of 383,000,000 cu. ft. of natural gas daily, moving the fuel from the Texas Gulf Coast near Corpus Christi to Joliet, Ill., where it will be distributed to the metropolitan Chicago area. This capacity ultimately will be stepped up to 524,000,000 cu. ft. daily through use of additional compressor stations.

New England Project

The Price company was awarded a contract in March of this year for construction of a 156-mile, 24-in. high-pressure natural-gas pipe line for Tennessee Gas Transmission Co. between Hamburg, N. Y., and the Onondaga-Madison county line in New York State. Work was completed on August 1, under Spread Superintendents G. A. Reutzel and R. K. Shivel. Price completed a 373-mile, 26-in. extension to Buffalo from Kentucky for T.G.T. before beginning work on the Buffalo-Onondaga-Madison county line project.

The first natural-gas pipe line to serve the New England area, the 156 miles of 24-in. from Hamburg represents an important addition to T.G.T.'s expanding system. From a point at the Hudson River, T.G.T.'s subsidiary, Northeastern Gas Transmission Co., will take over and make natural-gas deliveries to Massachusetts, New Hampshire, and Connecticut.

Work on the 24-in. line across New York State began in May. In order that T.G.T. could meet its commitments on schedule, the 278-mile stretch from Hamburg to the Hudson River was divided between several contractors, with Price getting the major 156-mile portion.

Tough Country

The rolling country over which Price gangs operated was filled with countless road crossings, creeks, and swamps, and some boggy areas extended more than a mile across. Despite these obstacles, the Price section of the new line was the first to be completed.

The New England line is the latest and most outstanding development of Tennessee Gas' system. At present the firm and its subsidiaries have authorization to construct a total of 1,663 miles of new pipe lines and to add 133,100 compressor horsepower, including construction of seven new compressor stations. Completion of these facilities will boost T.G.T.'s total daily capacity to 1,310,000,000 cu. ft. of gas daily.

Northeastern is presently undertaking construction of 500 miles of distribution lines for delivery of up to 220,000,000 cu. ft. daily to various utility companies in New England.

Spread crews.—G. A. Reutzel, superintendent of one spread, had as his personnel on this work, the following: W. E. Yount, office manager, J. A. Hairston, right-of-way foreman; L. J. Loncarich, ditch foreman; J. C. Anderson, bending foreman; H. C. Morrison and K. N. Adkins, pipe foremen; R. W. Orr, welding foreman; S. J. Wood, coating foreman; A. L. Bell, lower-in foreman; T. E. Walker, clean-up foreman; and J. H. Ingram, Sr., equipment foreman.

R. K. Shivel, superintendent of the other spread working on the New England job, had the following as his personnel: W. R. Crego, office manager; J. D. White, right-of-way foreman; W. H. Olrich, ditch foreman; J. H. Latham, bending foreman; Delbert Shivel, pipe foreman; R. L. Ezell, welding foreman; J. B. Northcutt, coating foreman; C. W. Sisco, lower-in foreman; Sam Price, clean-up foreman, Cleo Robertson, road-crossing foreman; and Tommie Stammer, equipment foreman.

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Price Anniversary

(Continued from page 131)

largest welding contractor in the United States. This position was further strengthened by the company's introduction of the shielded arc.

Pipe-line joints were generally of the bell and spigot type, and only bare electrodes were available. These bare-rod welds were often brittle and coarse-grained and even with Price's skilled welders, special care was necessary in order to make satisfactory welds.

It was the custom to weld each joint twice around, the first weld being known as the "burning in" bead, and the second as the "finishing" bead. By this process of double welding, possibility of pin-hole leaks was minimized. One of the big jobs in 1929 was on a 12-in. oil line from Oklahoma to Chicago for Texas-Empire Pipe Line Co.

Welding Engineering Co. had been experimenting with a heavily coated electrode known as the "shielded arc." Use of this rod, coating of which protected the arc from atmosphere, was found to result in a weld that was very fine grained, free of oxides and nitrides, and therefore very ductile and tough.

The first line to be Price-welded with the heavily coated electrode was for Cities Service Pipe Line Co. in 1930. This was a 32-mile gas line of 20-in. diameter and was the first time that electric welding had been used on such large-diameter pipe without expansion joints or couplings between welds.

The company was forced to change over all its welding equipment to larger size, since the original welding machines generated only enough current for small-diameter bare rod and were inadequate on the Cities Service shielded-arc job. Forty 400-amp. gasoline-driven generators were purchased to replace the outmoded equipment.

After obtaining the larger welding machines, Welding Engineering Co. welded a large portion of the 24-in. gas line from the Texas Panhandle to Chicago for Natural Gas Pipeline Co. of America. Other jobs followed, including 205 miles of 18, 20, and 22-in. for Columbia Gas & Electric Corp. in Indiana.

Back-up Ring Eliminated

The coated rod eliminated many welding problems; but Price was not satisfied with the conventional methods of pipe-line construction, which, he felt, were too slow and costly. Adoption of the double-bell joint and chill ring, together with the shielded-arc method of welding, speeded up the work by more than 300 per cent. This reduced cost of electric-welding pipe lines, particularly gas lines of large diameter.

Price crews used, on plain-end

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pipe, a back-up ring which was originally of heavy construction with a wide spacing hump in the center, later a 2-in. ring only $\frac{1}{16}$-in. thick, and a spacer only $\frac{1}{8}$-in. wide. The small ring was particularly advantageous when plain-end pipe was used as it furnished little obstruction to flow of products through the lines.

Use of the coated rod for electric welding without use of back-up rings was thought impractical because the weld metal was too fluid. The inside ring could be used with plain-end pipe on large-diameter gas lines because the ring did not impede the flow of gas. But on oil and gasoline lines, which were then never over 12 in. in diameter, a back-up ring could not be used unless both ends of the pipe were belled, making the inside diameter the same throughout the line.

This double belling, plus the ring, was too costly; consequently, the cost of an electric-welded oil line was greater than that of an acetylene-welded line. In order to meet competition, a way had to be found to weld without use of a permanent inside ring.

Finally, Price developed a collapsible, and removable, inside back-up ring made of copper or brass.

In 1933 the company contracted to weld 227 miles of 8-in. from Oklahoma City to Thrall, Kans., for Phillips Petroleum Co. This contract was with the understanding that the company would use only the collapsible back-up ring. From the beginning of the job, nothing but trouble was encountered. The collapsible ring would back up the weld, but the weld would stick to the copper. After 10 miles of very slow progress it looked as though the firm couldn't comply with specifications.

It was suggested that the back-up ring be eliminated entirely. In the presence of Phillips engineers and inspectors, a trial weld was made—and it worked perfectly. Upon completion the line was tested at 1,200 lb. oil pressure, which was maintained for 48 hours. There were no leaks.

Later came 70 miles of 12-in. for Sinclair Prairie Pipe Line Co., and 24 miles of 6-in. for Great Lakes Pipe Line Co.—both jobs without use of back-up rings. Rings were still used on larger-diameter pipe, because they provided a foolproof weld, necessitating only two beads instead of three.

Gradually, however, as welders became more experienced, the back-up ring was eliminated altogether on all diameter pipe.

The Stove-Pipe Method

Price was working toward two goals—more speed, better welds. Each new welding development speeded up work and made a better line, but he was still not satisfied.

The usual method of pipe-line construction, in 1936, was to line up joints of pipe on skids and dollies and roll weld ahead of or alongside the ditch into sections about 200 ft. long. These sections were then placed over or in the ditch, and tied in with bell-hole or position welds.

On a job for Hope Natural Gas Co. through rough terrain of West Virginia, Price used the stove-pipe method of welding—an innovation then. This method, where pipe remains in position instead of being rolled, had been used previously on short and small-diameter lines, but never on a major pipe line of this size.

The job was started August 13, 1936, and the 94-mile line was successfully completed November 27. There were 24,765 welds in the line, and only one leak developed under final test. The stove-pipe-welding method was found particularly efficient in rough country, and more economical on small-diameter pipe. Savings resulted from elimination of line-up gang, less moving and handling of pipe, use of smaller equipment for welding and handling pipe, less right-of-way and property damage.

Foreign Jobs

H. C. Price Co.'s first foreign job was the laying of a 100-mile pipe line for Mene Grande Petroleum Corp. in

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Venezuela in 1939. The 16-in. pipe was welded without use of a back-up ring, and the job was completed 6 weeks ahead of schedule. Subsequently, the company's activities have covered Canada, Alaska, and the Middle East, as well as nearly every state in the Union.

War Changes Picture

Price specialized only in contracting the electric welding of pipe lines until the beginning of World War II. But during the war the company expanded into general pipe-line construction and, in joint ventures with associated companies, completed a number of the larger pipe-line projects built during that period. In addition, the Price organization extended its activities to ship building and airplane-modification work. Many of its key personnel were assigned to shipyards and war plants in which the company had an interest.

Joint ventures.—The Price company, with W. A. Bechtel Co. and W. E. Callahan Co., formed Bechtel-Price-Callahan, to handle the Canol pipe-line project. In 20 months the joint company was to conquer an undeveloped area one-third the size of the United States, pioneer 2,000 miles of road through the wilderness, lay 1,700 miles of pipe line, build a refinery at Whitehorse, and transport thousands of workmen and tons of material to the job, 1,000 miles from civilization.

"Big Inch."—The Price organization laid a large portion of the War Emergency Pipelines projects known as the "Big Inch" and the "Little Big Inch," which were rushed to completion to provide fuel oil to the East Coast.

Postwar.—Major jobs the company has carried out since the end of World War II included building of the "Biggest Inch," for Southern California and Southern Counties Gas companies, then the largest-diameter pipe ever laid; and the "Toughest Inch," an outstanding pipe-line-construction feat for Columbia Gas System, Inc., in 1949. The Toughest Inch, a 268-mile 26-in. line, was laid over the rugged Appalachian region, in almost inaccessible areas, under the most tortuous conditions. The line snakes from Clendenin, W. Va., to Rockville, Md., where it is now delivering natural gas to the Washington, D. C., metropolitan area, and to Baltimore. Laying of the line amounted to the all-time high of $15 per foot, or nearly $80,000 per mile.

Many innovations were tried successfully by Price crews on this job, for the jagged terrain made orthodox methods of ditching and stringing useless.

Personnel

Harold C. Price not only has pioneered in the laying of petroleum-industry pipe lines and introduced a number of "firsts" to cut laying time and costs, but he has become nationally known for honest, integrity, and dependability. He is backed by an organization of trained and experienced men. Among the key personnel are: J. B. Harshman, vice president of the pipe-line division; J. S. Dewar, vice president of the Somastic division; John M. Thomas, manager of the pipe-line division; R. P. White, manager of the Somastic division; E. L. Gallery, secretary-treasurer; John P. Overton, assistant treasurer; Roy E. Burgess, administrative assistant, pipe-line division; Sam H Paxson, purchasing agent; Bennie G Pierce, safety director; David J. Kerr, public relations director; G. A Reutzel, superintendent of Spread 1; R. K. Shivel, superintendent of Spread 2; C. E. Shivel, superintendent of Spread 3; C. R. Ice, superintendent of Spread 4; Montie J. Lane, superintendent, Somastic division, Philadelphia; and Nelson Versoy, superintendent, Somastic division, New Orleans.

Other staff members include: W. E Yount, office manager, Spread 1; W. R Crego, office manager, Spread 2; Dan Johnston, office manager, Spread 3; George Harvey, office manager, Spread 4; T. L. Huitt, office manager Philadelphia Somastic division office and M. E. Anderson, New Orleans Somastic division office manager.

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QUESTIONS on TECHNOLOGY

by W. L. Nelson
Consulting Engineer

Thermal Cracking Yields and Rates

Is there any published correlation of thermal cracking rates and product distribution as a function of the physical and/or chemical properties of a feed?—E. S.

Although cracking has been practiced commercially for many years and although millions of dollars have been spent on research on cracking (decomposition and polymerization), the reactions are so complex, particularly when practiced on feeds that are mixtures, that a complete mathematical understanding is not available. Even such an apparently basic matter as gasoline yield cannot be stated with certainty. Only recently five proposals and guarantees by nationally known engineering contractors, all based on the same operation, were examined and compared, and the gasoline yields varied by plus or minus 15 per cent about an average. These contractors are better informed than any other responsible agencies or research workers and yet there is a difference of opinion or of experiences.

About the only published yield correlations are the gross approximations given on pages 576-581 of the Third Edition of Petroleum Refinery Engineering (McGraw-Hill Book Co., Inc., New York, 1949) and the gasoline yields given there were developed mainly in 1931. Furthermore, the gasoline-yield formulations given there involve substantially nothing more than the gravity of the feed stock and the gravity of the cracked fuel. Rate of cracking as discussed on pages 581-587 of the same reference, is based almost totally on the kinds of charge stocks (by name) and the gasoline yield.

Only one extensive study of the rate of formation of other products, as well as gasoline, appear in the literature, namely, the work of Sung, Brown, and White (Thermal Cracking of Petroleum, Ind. Eng. Chem., 37, page 1153, 1945). Their work shows the reaction velocity constants when producing gas only, when producing gas and material boiling up to 200° F., etc., covering the range up to material boiling at 600° F. Two of their curves are shown on Fig. 1.

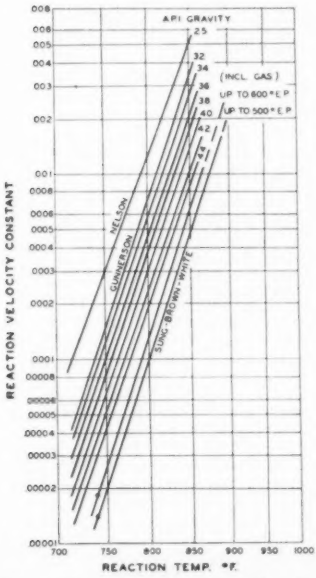


Fig. 1—Illustration of the relation of product gravity to the reaction velocity constant.

It should be noted that different products from the conventional gas, gasoline, and recycle stock, or different proportions of them, cannot be produced by regular cracking processes—that other variables such as pressure, phase condition, etc., must be altered if the kind of product is to be greatly altered.

One other closely related study is available. L. Gunnerson in a master's thesis at University of Tulsa, "Operating Variables and Reaction Rates in Vacuum Decompositions," studied the rate of cracking when different products ranging in gravity from 30° to 38° A.P.I. were produced. A series of runs was conducted in which a different gravity of product was produced during each run. This was accomplished by varying the pressure. As might be expected, the lower the gravity of the product, the greater the yield. These data do check generally with the results of other workers, as indicated in Fig. 1. However, Gunnerson decomposed a 24° A.P.I. topped crude oil, the Nelson 25° A.P.I. product was produced from a solid asphalt, and the 500° and 600° F. products of Sung et al were obtained from a 31.5° A.P.I. gas oil.

Finally, the yield equations for gasoline published in Petroleum Refinery Engineering have been improved or explored on this page, particularly for the effect of gravity of charge stock. These discussions appeared in the following issues:

Cracking Yields from Heavy Charge Stocks, July 22, 1948, page 94.

Cracking Low-Gravity Stocks, July 20, 1950, page 99.

Cracked Residuum Lighter Than Charge Stock, October 4, 1951, page 326.

These studies indicate strongly that gasoline yield is not a simple function of the degradation of the feed (gravity) to the gravity of the cracked fuel oil, but that the gravity of the feed stock affects the yield in some further way and that to degrade a 30° A.P.I. stock to a 25° A.P.I. fuel oil results in a different yield relationship than to degrade a 15° A.P.I. stock to 10° A.P.I.

Product Quality

The relationship of yields and rates to product qualities is also not clearly defined. The kinds of hydrocarbons produced appears to be related almost completely to temperature *(Effect of Temperature on Products of Thermal Cracking, this page, The Oil and Gas Journal, August 23, page 161)*. High temperatures (1,300° F.) result mainly in aromatic hydrocarbons with smaller amounts of diolefins and olefins, whereas low temperatures (950° F.) result in olefins, naphthenes, and paraffins. The characterization factors of thermally cracked stocks were described as a function of their boiling ranges on this page, *("Characterization Factor of Cracked Stocks," The Oil and Gas Journal, February 10, 1949, page 97)*.

Octane number is also affected mostly by the temperature of cracking, ranging from about 65 (motor) at 900° F. to 74 (motor) at about 1,100° F. However, octane number is also affected by the paraffinicity of the feed *(Mithoff, et al, California Crude Oils, The Oil and Gas Journal, November 6, 1941, page 81)*. Their results indicate somewhat as follows:

Characterization factor of feed	Oct. No. (clear) Motor	Research
11.0	75.4	89.4
11.2	73.2	87.8
11.4	71.3	85.0
11.6	69.2	81.4
11.8	67.1	76.6
12.0	65.0	71.6
12.2	62.5	66.0

Finally, gasoline yields are described in the same Mithoff article, as a function of the viscosity of the feed stock and the viscosity of the cracked fuel oil. This has been summarized more recently on the Questions on Technology page (June 29, 1950, page 88).

Hydrocarbon Cracking

Yields by the cracking of hydrocarbons are fairly well defined although to what extent primary products are destroyed by the secondary polymerization reactions that always occur in cracking, cannot be completely known. However, yields are related to rate in only a most approximate way. The following decom-

position yields are taken from summaries in Petroleum Refinery Engineering, pages 580-581:

Ethane decomposition:

$$C_2H_6 = C_2H_4 + H_2$$

Propane decomposition:

$$C_3H_8 = C_2H_4 + CH_4 \ (63.5\%)$$

$$C_3H_8 = C_3H_6 + H_2 \ (30\%)$$

$$2C_3H_8 = 2C_2H_2 + C_2H_4 \ (6.5\%)$$

$$100C_3H_8 = 30H_2 + 63.5CH_4 + 66.75C_2H_4 + 6.5C_2H_2 + 30C_3H_6$$

Butane decomposition:

$$100C_4H_{10} = 19.25C_2H_2 + 33C_2H_4 + 30C_3H_6 + 16C_3H_4 + 33.5C_3H_8 + 49\,CH_4 + 1.5H_2$$

Isobutane decomposition:

$$100iC_4H_{10} = 29iC_3H_8 + 43C_2H_4 + 5.5C_2H_2 + 22.5C_3H_6 + 5.5C_3H_4 + 65.5CH_4 + 6.5H_2$$

Propylene (heated):

$$100C_3H_6 = 17H_2 + 45CH_4 + 42C_2H_2 + 4.1C_2H_{2.5} + 26.6C_{2.5}H_{1.16}$$

Lost Circulation

(Continued from page 113)

it was felt that the wells when completed were not nearly as good as they should have been. An average of 1,500,000 cu. ft. of gas per day is required for drilling and keeping the hole clean and, of course, lost circulation has been eliminated.

On one well observed by the author, 822 ft. of hole was made with two bits in 27¾ hours, and only 19½ hours was actual rotating time on bottom, the other 8¼ hours being spent in reaming, jetting, and making connections. Mud used on this well amounted to the ridiculously low figure of 47 sacks of bentonite for spudding. Before introduction of gas drilling, average drill-in time with mud ranged from 10 to 14 days, and 10 to 14 bits.

Now to return to the question, "What can we do about lost circulation?" Obviously, lost circulation can never be entirely eliminated, but by a well-planned attempt to control the mechanical factors contributing to it much may be done to reduce the severity and frequence.

Those in control of the vast majority of rigs operating in the United States, certainly have the power to reduce pressure surges which may be found to be causing loss in critical wells. Where trips are numerous, it might prove costly to increase the amount of time going in the hole, but if evidence can be supported proving new losses or rupture of old ones (as in the case of porosity coated with sealing materials) from rapid lowering of drill pipe, arrangements for suitable compensation could probably be made with the operator. Further, there seems to be no reason why circulating pumps cannot be opened slowly, or why the pumps should be kicked in before the kelly is lowered after having made a routine mousehole connection.

Reservoir Analysis of Redwater Pool

(Continued from page 92)

eral, the trends in porosity correlated very well with facies distribution maps which have been made, indicating further that the type of rock material present is the controlling factor.

By combining the isoporosity map with the structural contours, an isopach map was obtained. The values on this map represent the net fluid column thickness, as determined by multiplying the porosity at any point by the corresponding total thickness of the oil zone.

The effective permeability throughout most of the formation is quite high, probably due to the large amount of fracturing. Specific productivity indexes of the wells range generally from 0.5 to 4.0 bbl. per day per foot per psi. Except in the northwest portion, low pressure differentials also indicate good communication within the reservoir.

TABLE 3—SUBSURFACE SAMPLE AND RESERVOIR FLUID CHARACTERISTICS, REDWATER POOL

Original Reservoir Conditions

Pressure, psig.	1,050
Temperature, °F.	94
Datum depth, (ft., subsea)	1,165

	Imperial Redwater No. 1	Imperial Amelia No. 1
Sampling conditions—		
Date	10-29-48	3-4-49
Sampling depth—ft. subsea	1,128	1,138
Sampling pressure—psig.	1,050	1,038
Sample temp.—°F.	94	94
Sample data—		
Saturation pressure, psig.	485	480
Compressibility, bbl./bbl./psi.	6.73×10^{-6}	7.94×10^{-6}
Specific vol. at sat. pr. and temp., cu. ft./lb.	0.02008	0.0200
Reservoir bbl./bbl. surface oil:		
Flash liberation	1.133	1.1468
Differential liberation	1.120	1.145
Solution gas—cu. ft./bbl. surface oil:		
Flash liberation	215.0	242.0
Differential liberation	180.0	211.0
Gravity of stock tank oil:		
Flash liberation	34.8	33.8
Viscosity of reservoir oil at 94° F. centipoises:		
At satur'n press.	2.68	2.50
At sample press.	2.87	2.73
Sample composition, mol per cent—		
Methane	10.54	9.06
Ethane	6.20	6.37
Propane	7.01	7.40
Isobutane	1.76	2.03
n-Butane	5.33	4.76
Isopentane	2.80	2.33
n-Pentane	2.43	1.74
Di-isopropyl plus	...	62.77
Hexane	4.86	.....
Heptane plus	57.05	.....
Hydrogen sulfide	1.81	1.27
Carbon dioxide	0.21	1.27
Mol wt.—Residue	238	222
Sp. gr.—Residue	0.870	0.870

The average effective horizontal permeability of the formation has been estimated as 500 md. While the effective vertical permeability is more difficult to determine, there is no indication that any dense limestone or shale streaks are continuous over large enough areas to be considered as major barriers to the vertical movement of fluids.

Median ratios of horizontal to vertical permeability, determined for individual wells by core analysis, usually vary from 1.5 to 10.0. These values, however, probably do not give enough weight to vertical fracturing, since the core samples containing these fractures are often unsuitable for analysis.

Reservoir Fluids

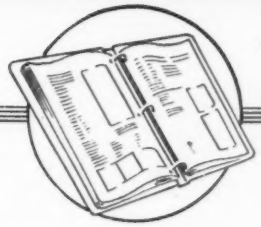
Bottom-hole samples from seven wells in Redwater field have been obtained and analyzed. A summary of all complete data for two wells is shown in Table 3.

Connate Water

Up to the present time, no reliable average connate-water value for the preservoir has been determined. A figure of 15 per cent has been used for oil-in-place calculations, this value being selected as typical of a vuggy limestone.

Results of distillation of cores taken with heavy oil, and laboratory mercury injection tests, indicate ranges of from 0 to 10 per cent connate water in large vugs, 20 to 30 per cent in intergranular material, and 50 to 100 per cent in the matrix porosity. Until a complete study is made to determine what proportion of the total void space in the reservoir is contributed by each type of porosity, there is no way to make an estimate of the weighted average value.

The relative amounts of void space in the vuggy material, which has low porosity but occupies the largest portion of the reservoir, and that in the smaller volume of high porosity intergranular material, will probably be the most important factors. Much of the matrix porosity is automatically eliminated due to low permeability, and that which is included because vugs or fractures provide permeability is only about 2 per cent porosity. Therefore, even with the very high connate water in this type of material, the effect it will have on the average for the reservoir is expected to be small.



THE REFINER'S notebook

No. 93

Refractory Specialty Products

by Ray A. Witschey*

THIS important group of products includes the refractory and insulating materials which are furnished in the form of mortars, coating materials, castables, and plastic refractories.

Mortars. — High-temperature bonding mortars of many types have been developed for laying refractory brick and tile. They are supplied in either the dry or wet form. They are air setting or heat setting and can be furnished in a variety of grades. Shrinkage has been eliminated by controlled selection of raw materials and proper grain sizing. In fact, the volume changes in burning can be carefully controlled. Mortars that expand under heat treatment are used for some applications. Bond strengths as great as, or greater than, the brick with which they are used are common.

By the proper balance of physical properties, mortars with good water retention and excellent workability are possible. Such mortars make possible brick-to-brick joints and insure well-bonded, tight refractory structures.

Coatings.—It is common practice to coat new masonry with high-temperature mortars. Applied in thin coatings, such applications tend to seal the joints and offer some protection during the initial operation. Refractory coatings specially compounded for this application are, however, more satisfactory. Such coatings are designed to have high refractoriness, low shrinkage, good adherence, and volume stability that keep cracking, curling, and peeling at a minimum.

Refractory coatings can be applied by brushing, troweling, or with spray gun. Successful coating results generally require application in thin (¼ to ⅛-in.) layers. Thicker coatings can be built up by applying additional layers, if each individual layer is well dried or burned in before the next layer is applied.

Castable refractories.—These are mix - and - pour - type products applied in much the same manner as structural concrete. Essentially, refractory castables are mixtures of grog or calcine (aggregate), and high alumina hydraulic cement (binder). Lesser quantities of other materials are often added to produce certain desirable properties.

*Ceramic engineer, A. P. Green Fire Brick Co. Portion of paper presented at John Zink Heating Seminar, Tulsa, 1951.

TABLE 1—PROPERTIES OF SOME REFRACTORY AND INSULATING CASTABLES

Product— Class—	Kast-Set Refractory castable	Kast-O-Lite Insulating refractory castable	Kast-Set KS-4 Refractory castable	Castable No. 20 Insulating castable	Castable No. 20 SK-7 Insulating castable	Castable block mix Insulating castable
Maximum recommended temperature, °F.—A.S.T.M. C 24-48 ..	2,750	2,500	2,750	2,000	1,800	1,600
Weight required per cu. ft.—lb.	110	77-81	110	48-52	46	20
Weight per cu. ft. in place—lb.:			*121		*50	
After pouring	128-133	103-108	128-130	83-87	75-80	72-76
			*135		*88-92	
Burned at 1,000° F.	108-113	77-81	109	53-56	42-46	23-25
			*120		*46-50	
Water required for tempering—gal. per 100 lb.:						
For tamping	1¾-2	3½-4		6		24-25
For pouring	2-2¼	4-4½	2¼-2½	7-8	9-10	25-26
Shrinkage—per cent contraction:						
Dried at 220° F.	—0.1	—0.1		0.3		None
Heated at 1,000° F.	0.1	0.2	.14 (.12*)	0.5	.48	0.4
Heated at 1,500° F.	0.1	0.3		0.7		1.0
Heated at 2,000° F.	0.2	0.3				
Modulus of rupture—A.S.T.M. C 133-39, psi.:						
Cured and dried at 220° F.	300-400	125-250	450-500	95-115	125-150	30-40
					*150-200	
Heated at 1,000° F.			250-350		75-100	
			*350-450		*100-125	
Heated at 1,500° F.	75-125	125-175				20-30
Heated at 2,000° F.	100-150	150-200		65-85		
Heated at 2,200° F.	300-400	175-250				
Heated at 2,300° F.	400-550	175-225				
Heated at 2,500° F.	650-800					
Cold crushing strength—A.S.T.M. C 133-39, psi.:						
Cured and dried at 220° F.	1,200-1,800	600-1,000		160-180		65-85
Heated at 1,500° F.	600-900	350-500				50-70
Heated at 2,000° F.	400-700	350-500		70-90		
Thermal conductivity, B.t.u./sq. ft./hr./°F./in.:						
Mean temperature of 200° F.				1.45	1.27	0.51
					*1.39	
Mean temperature of 600° F.	3.80	1.79	3.80	1.48	1.56	0.60
			*4.29			
Mean temperature of 1,200° F.	4.01	2.21	4.01	1.57		0.86
			*4.53			
Mean temperature of 1,500° F.	4.17	2.51	4.17			
			*4.71			

*Data apply to application with pneumatic equipment.

The test data shown above are average results of control tests and are subject to normal variations on individual tests. These results cannot be taken as maximum or minimum requirements for specification purposes.

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Measurement of Specific Gravity of Volatile Fluids Under High Pressure

IN operation of gas-condensate fields, it is advantageous to test periodically the well streams for liquid content at pressures ranging above 1,500 psig. This is obtained by test equipment which separates the gas and liquid, measures the two streams by orifice meters, and recombines them for pipe-line transmission.

One of the problems of measuring the volatile liquid stream is the determination of its specific gravity at operating pressures. The method described here for such determination has been found to give satisfactory results under varied field conditions. This method was originally devised by the U. S. Bureau of Mines.

A pycnometer of approximately 1,000 cc. capacity is filled with the liquid at operating conditions. The pycnometer is then suspended from a copper buoy and immersed in water. Brass weights are added to the buoy until a 0.5-g. weight causes the assembly to sink gradually. The pycnometer containing air or dry gas only is balanced again at atmospheric pressure. The difference between the two weights determined (with proper corrections being applied) is the weight of the volume of liquid sample.

The complete assembly is illustrated in the weighing position in Fig. 1.

Procedure:

1. Fill pycnometer by water displacement using precautions to prevent inclusion of gas.
2. Allow pycnometer to come to atmospheric temperature before disconnecting from source.
3. Suspend from buoy and immerse in water bath as illustrated.
4. Bring water bath to atmospheric temperature and determine specific gravity of the water with hydrometer.
5. Weigh pycnometer assembly by adding weights until the addition of a 0.5-g. weight causes the assembly to sink gradually or its removal permits the assembly to rise.
6. Remove pycnometer, empty, purge with air or gas, close valves when atmospheric pressure is obtained, and again weigh in assembled position. Precautions should be taken to maintain the water bath at the temperature of weighing as carried out under 5.
7. If temperature of water bath differs greatly from calibration temperature of the pycnometer it should be calibrated with water at the temperature of the water bath.

Specific gravity is then calculated by the formula:

$$\text{Sp. gr.} = \frac{(W_o - W_f)\,(1 - D_2S/D_2)}{V}$$

Where:

W_o = weight to balance with pycnometer evacuated, g.
W_f = weight to balance pycnometer containing liquid sample, g.
S = specific gravity of water at (t) temperature of weighing.
V = volume of pycnometer calibrated at or near temperature of water in weighing bath, cc.
D_1 = density of water at 60° F.
D_2 = density of brass (8.39 g./cc).

W_o, the weight to balance with pycnometer evacuated, is determined by the calculation:

$$W_o = W_{o_1} + W_g$$

Where:

W_{o_1} = weight to balance, with pycnometer containing air or gas (in g.).
W_g = weight of gas, g.

Using the value 0.001293 g. as the weight of a cubic centimeter of air at 14.696 psia. and 32° F., the weight of the air contained in the pycnometer can be calculated as follows:

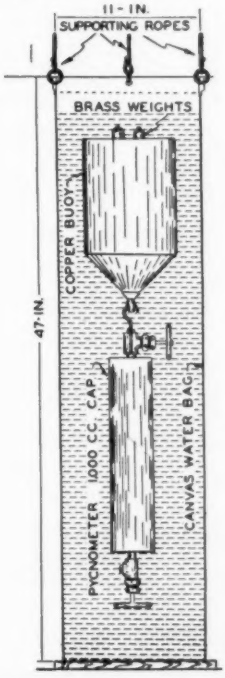


Fig. 1 — Pycnometer — copper buoy assembly.

$$W_g = 0.001293 \times \frac{460 + 32}{460 + t} \times \frac{P_a}{14.696} \times G_g \times V$$

Where:

t = temperature of water bath, °F.
P_a = atmospheric pressure.
G_g = gravity of gas used (air = 1.0).

The following sample data and calculations from an actual field determination illustrate the above calculations:

W_f, weight to balance pycnometer containing gas, g.	1,232
W_{o_1}, weight to balance pycnometer containing liquid, g.	525
Temperature of water bath at time of weighings, °F.	85
Specific gravity of the water in bath (from hydrometer)	1.00
Volume contained by pycnometer, cc.	972
Specific gravity of gas used for purging (air = 1.0)	0.733
Barometric pressure, psia.	14.634

(Symbols are defined above):

$$W_g = 0.001293 \times \frac{460 + 32}{460 + t} \times \frac{P_a}{14.696} \times G_g \times V$$

$$= 0.001293 \times \frac{492}{545} \times \frac{14.634}{14.696} \times 0.733 \times 972$$

$$= 0.83 \text{ g.}$$

$$W_o = W_{o_1} + W_g$$

$$= 1,232 + 0.83.$$

Sp. gr. of liquid sample

$$= \frac{(W_o - W_f)\,[1 - (D_1S/D_2)]}{V}$$

$$= \frac{(1,232.83 - 525) \times [1 - (0.999 \times 1.00/8.39)]}{972}$$

$$= \frac{(707.83)\,(0.8809)}{972}$$

$$= 0.6415 \text{ (at 85° F.)}$$

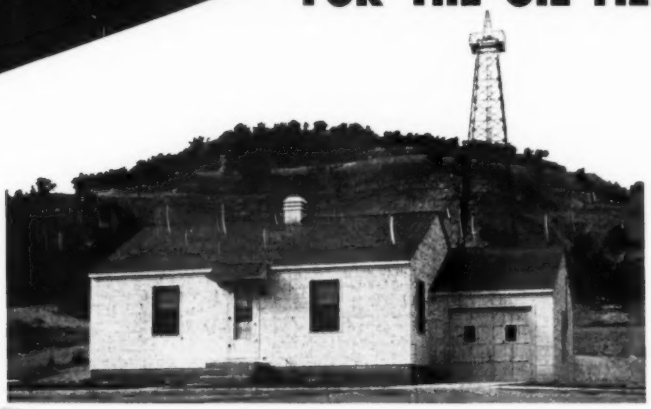
$$\text{°A.P.I. at 85° F.} = \frac{141.5}{0.6415} - 131.5$$

$$= 89.1\text{° A.P.I.}$$

°A.P.I. at 60° F. = 84.8° A.P.I. (from tables) at 2,000 psig.

Specific gravities, calculated from Podbielniak analyses, were compared with those obtained by the above field procedure with satisfactory results, the difference between the two values being less than 1 per cent.

WHY STURDYBILT PREFABRICATED HOUSES FOR THE OIL FIELDS?



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Pipe-Line Construction

FOLLOWING is a tabulation of pipe-line projects which are planned or under construction. Included are crude-oil, products, and natural-gas lines. This list is compiled from surveys made by The Oil and Gas Journal.

Crude-Oil Pipe Lines

Alberta-Vancouver Oil Pipe Line Co. (Brokaw, Dixon, McKee).—972 miles, 16-in., proposed, Edmonton via Pincher Creek, Alta., Idaho and Washington states to Vancouver, B. C.

Continental Pipe Line Co.—105 miles, 8-in., authorized, Rincon to northwest of Sullivan City on to Port Isabel, Tex. Completion date 1952.

Continental Pipe Line Co.—217 miles, 12-in., authorized, Wichita Falls, Tex., to Ponca City, Okla. Completion date 1952.

Derby Oil Co.—18 miles, 6-in., authorized. Wichita to Bentley, Kans. Completion date 12-51.

Gulf Refining Co.—87 miles, 14-in., contracted, Lumberton, Miss., to Mobile, Ala. Anderson Bros. Completion date, 1-1-52.

Ohio Oil Co.—117 miles, 22-in., under way, Sheridan, Ind., to Lima, Ohio. R. A. Conyes, contractor.

Pan American Pipe Line Co.—27 miles, 26-in., Genoa to Texas City, Tex. Completion date 12-52.

Pan American Pipe Line Co.—40 miles, 14-in., Arden Station in Irion County to Eldorado Station in Schleicher County. 6-52.

Phillips Oil Co.—28 miles, 12-in., authorized, Sweeny to Freeport, Tex.

Phillips Oil Co. — Authorized, Midland, Glasscock, Reagan, and Upton counties.

Platte Pipe Line Co.—1,075 miles, 16-20-in., under way, Worland, Wyo., to Wood River, Ill.

Platte Pipe Line Co.—573 miles, 16-20-in., under way, Winchester, Wyo., to Brule, Neb. R. H. Fulton & Co. (Sections 1, 2, 3, and 4.—Section 1, 126 mi. of 16-in., remainder 20-in.). A. A. Carrigan, spreadman at Casper, Wyo., field office.

Platte Pipe Line Co.—142 miles, 20-in., under way, near Marysville, Kans., to Holdredge, Neb. Bishop & Lock (Section 5); H. LaQuey, spreadman.

Platte Pipe Line Co.—100 miles, 20-in., under way, northern edge of Kansas. Rumsey Bros., contractor of Section 6.

Platte Pipe Line Co.—(Section 7). 274 miles, 20-in., Missouri River to Salisbury, Mo., and (Section 8) Salisbury to Mississippi River, under way, field office, Mexico, Mo., B. C. Hall, spreadman; River crossing field office, Hartford, Ill., Dick Jernigan, spreadman.

Progress Pacific Pipe Line Co.—900 miles, 20-in., proposed, Permian basin, West Texas, to California.

Rancho Pipe Line System.—464 miles, 24-in., authorized, McCamey to Houston, Tex. Company crews. Completion date 1952. (Joint project with Sinclair Pipe Line Co., Pan American Pipe Line Co., Tidewater Pipe Line Co., Nantucket Pipe Line Co., and Phillips Pipe Line Co., with Shell Pipe Line Corp. handling construction and operation.)

Rancho Pipe Line System.—66 miles, 8-in., authorized, Gohlke to La Grange, Tex. Company crews. Completion date 1952.

Roosevelt Oil & Refining Corp.—22 miles, 4 and 6-in., authorized, St. Helens to Norwich, Mich.

Service Pipe Line Co.—19 miles, 16-in., under way, Raytown to Sugar Creek Ref., Mo. Sheehan Pipe Line Const. Co., contractor. J. W. Brown, spreadman at Raytown, Mo.

Service Pipe Line Co.—29 miles, 20-in., authorized; Drumright, Okla., to Humboldt, Kans.; contracted, Smith Contracting Corp.; 30 miles, 20-in., authorized, Freeman to La Plata, Mo.; 24 miles, 10-in., contracted, Denton, N. M., to Wasson, Tex., Crossley and Hardy, contractor.

Sinclair Pipe Line Co.—674 miles, 22-24-in. authorized; Drumright, Okla., to E. Chicago, Ind.

Texas-New Mexico Pipe Line Co.—75 miles, 8-in., planned, Midland to Germania pool; Midland to Scarborough and Sweetie Peck area; and Crane station to McElroy area, West Texas.

Texas-New Mexico Pipe Line Co.—55 miles, 8-in., planned, Eunice to Covington and Saunders area, New Mexico.

West Texas Gulf Pipe Line Co.—467 miles, 26-in., authorized, Colorado City to Wortham, Tex., 26-in.; Wortham to Sour Lake, Tex., 24-in. Completion date 10-52.

West Texas Gulf Pipe Line Co.—114 miles, 20-in., authorized, Wortham to Longview, Tex. Completion date 10-52.

Products Pipe Lines

Bell Oil & Gas Co.—150 miles, 6-in., planned, Ardmore to Drumright, Okla.

Buckeye Pipe Line Co.—430 miles, 14-in., proposed, Linden, N. J., to Allentown, Pa., Junction; Chelsea, Pa., via Allentown Junction to Auburn, Rochester, Syracuse and Oswego, N. Y. Start 1952; finish 1953.

Ohio Oil Co.—24 miles, 8-in., authorized, East St. Louis to Wood River, Ill.

Phillips Pipe Line Co.—46 miles, 12-in., under way, looping from Buffalo, Okla., to Borger, Tex. Arey Phillips Const. Co. 10-51 completion date.

Phillips Pipe Line Co.—48 miles, 12-in., under way, looping from Wichita, Kans., to Buffalo, Okla. G. G. Griffis Const. Co. Joe Bishop, spreadman, at Wichita, Kans. 11-51 completion date.

Phillips Pipe Line Co.—101 miles, 8-in., under way, looping from East St. Louis to Decatur, Ill. Brown Lite Co., contractor. R. E. Carraker, spreadman at Taylorville, Ill.; Hedge Edmonds, spreadman at Litchfield, Ill. Completion date 11-51.

Phillips Pipe Line Co.—74 miles, 8-in., under way, looping from Decatur, Ill., to East Chicago, Ind. Somerville Const Co., contractor. 12-51 completion date.

Phillips Pipe Line Co.—69 miles, 12-in., authorized, looping from Paola to Wichita, Kans.

Phillips Pipe Line Co.—137 miles, 10-in., authorized, looping from Paola, Kans., to East St. Louis, Ill. Completion date 11-1-51.

Plantation Pipe Line Co.—707 miles, 14 and 18-in., under way, Baton Rouge to Charlotte, N. C., 275 miles, 14-in., under way, Bremen to Charlotte, N. C.; 432 miles, 18-in., under way, Baton Rouge to Bremen, Ga.; 220 miles, 18-in., Baton Rouge to Mississippi-Alabama state line; Williams Brothers Co. David R. Williams, Jr., project manager.

Progress Pacific Pipe Line Co.—900 miles, 10-in., proposed, California to West Texas.

Salt Lake Pipe Line Co.—Proposed, Pasco Wash. to Puget Sound.

Sinclair Pipe Line Co.—8-in., proposed, Sinclair, Wyo., to Salt Lake City, Utah; 10-in., Houston to Baton Rouge; 16-in., Kalamazoo to Detroit; 20-in. Marcus Hook to Bayonne, N. J.; East Chicago to South Bend, Ind.

Standard Oil Co. (Ind.).—122 miles, 8-in., under way, Neodesha, Kans., to Belton, Mo. Bills & Troth Construction Co., Carl Bills, superintendent, at Armory Building, Neodesha.

Standard Oil Co. (Ohio).—17 miles, 6-in., authorized, Toledo to West Toledo, Ohio.

Tuscarora Oil Co., Ltd.—61 miles, 10-in., authorized, Knappenberger to Midland, Pa.

Natural-Gas Pipe Lines

Algonquin Gas Transmission Co. — 376 miles, proposed, Greenwich, Conn., to Boston area; 492 miles, proposed, laterals New England area.

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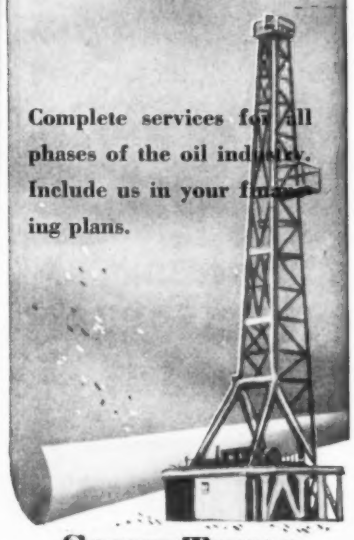

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Allied Gas Co.—24 miles, 6⅝-in., proposed, McLean to Champaign County, Ill.

Amere Gas Utilities Co.—11 miles, 8-in. authorized KA-5 loop, Priceton and Athens, W. Va. Completion date December 1951.

Amere Gas Utilities Co.—16 miles, 8⅝-in., proposed, loops from Mercer County to Princeton, W. Va.

Amere Gas Utilities Co.—15 miles, 8⅝-in., proposed, near Dameron to Flat Top, W. Va.

Arkansas Louisiana Gas Co.—16 miles, 8⅝-in., Claiborne Parish to Columbia County, Ark.

Associated Natural Gas Co.—88 miles authorized, Missouri.

Associated Natural Gas Co.—14 miles, 6-in., under way, Sikeston to Charleston, Mo. Boot Heel Construction Co. Completion date 12-1-51.

Carolina Natural Gas Corp.—185 miles 2-12-in., proposed, lateral lines off Transcontinental in North and South Carolina.

Cities of Booneville and Baldwin, Miss.—96 miles, ¾ and 6-in., under way, Booneville and Baldwin, Miss.; M. L. Hulcher Co. Inc., contractor, Sam Carnahan, spreadman Completion date November 1, 1951.

Cities Service Gas Co.—177 miles, 4-30-in., under way, Grant, Stanton, Hamilton, Kearny, and Finney counties, Kansas. Vaughn & Taylor Construction Co., Inc. Completion date 11-15-51.

Cities Service Gas Co.—80 miles, 4-22-in., under way, Grant, Haskell, and Seward counties, Kansas. Cheek Construction Co. Completion date 12-1-51.

Cities Service Gas Co.—179 miles, 4-30-in., gathering system in vicinity of Ulysses, Kans. Vaughn & Taylor Const. Co., Inc. D. D. Vaughn, spreadman, Ulysses.

Coast Counties Gas & Electric Co.—40 miles, 3, 4, and 8-in., planned, Coast and Valley region, California.

Colorado Interstate Gas Co.—250 miles, 20-in., under way, Kit Carson, Colo., to Amarillo, Tex. R. H. Fulton & Co., contractor. Jerry Nash, spreadman at Lamar, Colo.

Commonwealth Natural Gas Corp.—537 miles, 20-in., proposed, West Bend, Ky., to Norfolk, Va.

Consolidated Gas Utilities Corp.—24 miles, 10¾-in., authorized, Marlow field to Fort Sill, Okla. Completion date 12-1-51.

Cumberland and Allegheny Gas Co.—46 miles, 10-in., proposed, Mountain Lake Park, Md., to Preston County, W. Va.

Dow Chemical Co.—70 miles, various sizes, Midland, Saginaw, and Bay City, Mich.; Mahoney Contracting Co., contractor, Ralph Bucher, spreadman at Midland.

East Ohio Gas Co.—65 miles, 26-in., under way, near Petersburg to Cleveland, Ohio. Williams Bros., contractor. Completion date 12-1-51.

East Tennessee Natural Gas Co.—172 miles 22-in., authorized, Greenbrier to Oak Ridge, Tenn.

East Tennessee Natural Gas Co.—100 miles, 16-in. proposed, Knoxville to Kingsport, Tenn.

Egyptian Natural Gas Co.—80 miles, 6-8 in., authorized, Norris City to Salem-Centralia, Ill., area.

El Paso Natural Gas Co.—122.9 miles, 30 in., proposed, looping along main line in Texas, New Mexico, Arizona.

Empire Southern Gas Co.—22 miles, 2-3-4-in., authorized, Ozona, Crockett County, Texas, to Ozona Distribution system.

Equitable Gas Co.—17 miles, 16-in., under way, near Pittsburgh. H. L. Gentry Const. Co., contractor. Lavern Curtis, spreadman at Sewickley, Pa.

Georgia Gas Co.—32 miles, 4½-in., proposed, Bogart to Gainesville, Ga.

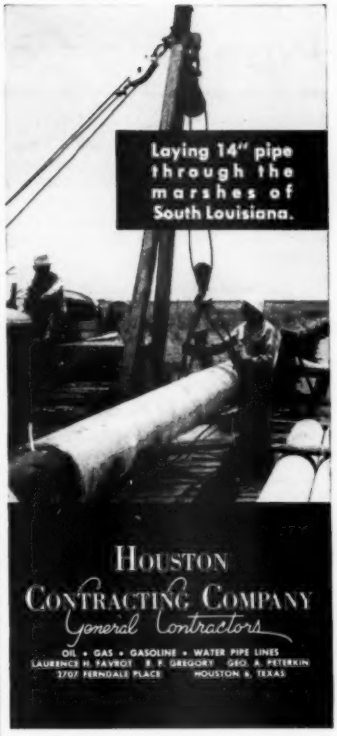
Grand Valley Pipe Line Co.—105 miles 8-10-in., planned, Piceance Creek field to Rifle on to Grand Junction, Colo.

Gulf Michigan Transmission Corp.—680 miles, 30-in., proposed, Perryville, La., across Arkansas, Missouri, and Illinois to terminus near St. John, Ind.

Home Gas Co.—17 miles, 12-in., proposed, loops from Hancock to Sanford, N. Y.

Iowa-Illinois Gas & Electric Co.—41 miles, 10-in., authorized, Washington County to Cedar Rapids, Iowa.

Kansas-Nebraska Natural Gas Co.—40 miles, 6-in., under way. Albion to Norfolk.



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Neb. Jayhawk Const. Co., Inc., contractor; F. A. Faler, spreadman at Albion.

Kansas-Nebraska Natural Gas Co.—30 miles, 6-in., under way, Albion to Neligh, Neb. Jayhawk Const. Co., Inc., F. A. Faler, spreadman at Albion.

Kansas-Nebraska Natural Gas Co., Inc.—60 miles, 8-10-12-in., under way, Grand Island to Albion, Neb.

Kansas - Nebraska Natural Gas Co.—65 miles, 2-8-in., planned, Big Springs field to Ogallala, Neb., and to Ovid, Colo.

Kansas-Nebraska Natural Gas Co., Inc.—39 miles, 4 and 6-in., planned, Neligh to O'Neill, Neb., 54 miles, 4 and 6-in. planned, Neligh to Hartington, Neb. (extension). Completion date 1952.

Kansas Power & Light Co.—27 miles, 20-in., authorized, Pratt, Kans., to Calista compressor station.

Lake Shore Pipe Line Co.—45 miles, 10¾-in., authorized, northwesterly from T.G.T. system near Meadville, Pa., to Ashtabula, Ohio.

Lion Oil Co.—140 miles, 6-30-in., gathering system for Diamond "M" Sharon Ridge refinery. George Tucker Pipe Line Const. contractor. Completion date 10-31-51.

Manufacturers Light & Heat Co.—78 miles, 16-in., contracted, Berwindale, Pa., to near Saltsburg, Pa. Britton Construction Co., contractors.

Michigan Consolidated Gas Co.—131 miles, 34-in., under way, Austin Storage fields to Detroit. Anderson Bros. Corp., contractor. Completion date 11-1-51.

Michigan Consolidated Gas Co.—180 miles, 34-in., planned. Austin, Mich., to Detroit.

Michigan Gas Storage Co.—94 miles, 8-24-in., authorized, Laingsburg to Mt. Clemens, Mich.

Michigan Gas Utilities Co.—77 miles, authorized, Sturgis, Hillsdale and Coldwater, Michigan. (22.7 miles, Marshall south to Coldwater; 20 miles, Coldwater easterly to Hillsdale; 22.5 miles, Hillsdale to Sturgis; 11 miles, Hillsdale to Jonesville).

MidSouth Gas Co.—240 miles, proposed, Greene, Poinsett, Crittenden, St. Francis, Lee, Phillips, Monroe, Woodruff, and Cross counties, Arkansas.

Montana Power Co.—18 miles, 16-in., proposed, Pakowki Lake area to Canada-Montana border.

Montana Power Co.—52 miles, 16-in., proposed, Canada - Montana border to Cut Bank, Mont.

Mississippi River Fuel Corp.—98 miles, 16 and 18-in., authorized, feeder line from Lincoln Parish, La., to Waskom field, Harrison County, Texas.

Mississippi River Fuel Corp.—40 miles, 18-in., authorized, Dubach to Perryville, La.

National Utilities Co. of Michigan.—76.7 miles, 20-in., proposed, South Central Michigan. (22 miles from near Marshall south to Coldwater; 20 miles east to Hillsdale; 22 miles southwest to Sturgis; 5 miles from Hillsdale to Jonesville and 6 miles west to Union City.)

Nevada Natural Gas Pipe Line Co.—114 miles, proposed, Topock, Ariz., to Las Vegas, Nev.

New River Gas Co.—50 miles, planned. Summers or Monroe counties, W. Va., to Narrows and Dublin, W. Va.

Niagara Mohawk Power Corp.—40 miles 10-12-16-in., under way, lateral lines at Utica, N. Y.; 55 miles, 10-in., Fulton to Watertown, N. Y.; Williams-Austin Co. contractor, Howard Bauer, supt.

Northeastern Gas Transmission Co.—511 miles 20-24-in., authorized, New Hampshire, Massachusetts, and Connecticut.

Northeastern Gas Co.—411 miles, proposed, New England towns.

Northern Natural Gas Co.—580 miles proposed, Kansas, Texas, Oklahoma, and Nebraska loops.

Northern Natural Gas Co.—370 miles 4-26-in., authorized, gathering lines in Hugoton field.

Northern Natural Gas Co.—317 miles, 26-in., under way, Palmyra, Neb., to Skellyville, Tex. G. G. Griffis Const. Co., contractor; field office, Beatrice, Neb.; G. L. Mims, superintendent; E. G. Grisham, spreadman.

Northern Natural Gas Co.—210 miles, 26-in., proposed, five loops in Texas-Oklahoma area, two in Kansas, and two in Nebraska

Northern Natural Gas Co.—181 miles, 4 12-in., contracted, gathering system in Hugoton area. Reese Bros. Const., contractor

Northern Natural Gas Co.—106 miles, 26-in., under way, Beatrice, Neb., to Mullenville, Kans. G. G. Griffis Const. Co. G. L. Mims, spreadman at Beatrice, Neb. Completion date 12-1-51.

Northern Indiana Fuel & Light Co.—32 miles, 8-in., proposed, Edgerton to Auburn Ind.

Northwest Natural Gas Co.—750 miles planned, Washington, Oregon, and Idaho.

Ohio Fuel Gas Co.—22 miles, 16-in. authorized, Dayton, Troy, Piqua, and Sidney, Ohio.

Ohio Fuel Gas Co.—23 miles, 16-20-in., authorized, Wellington to Elyria, Ohio; 16 miles, 20-in., authorized, Benton Station, to Crawford Station, completion date 11-15-51; 18 miles, 20-in., Crawford Station, to near Columbus, completion date 12-31-51; 16 miles, 16-in., authorized, Berlin Heights to Sandusky, Ohio, completion date 12-31-51.

Ohio Fuel Gas Co.—74 miles, 3 to 20-in., authorized, Hocking, Knox, and Ashland counties, Ohio.

Ohio Fuel Gas Co.—47 miles, 20-in., authorized, Benton Township, Hocking County, to Columbus, Ohio.

Ohio Fuel Gas Co.—61 miles, authorized, northern and southwestern Ohio.

Oklahoma Natural Gas Co.—16 miles, 8⅝-in., authorized, Shamrock to Cushing, Okla.; 23 miles, 24-in., authorized, Depew to Kellyville, Okla.; 9 miles, 12¾-in., Stroud to Depew, Okla.

Oklahoma Natural Gas Co.—40 miles, 16-in., under way, Ninnekah, Okla., to County Line, Okla.; Trojan Construction Co., contractor

Oklahoma Natural Gas Co.—36 miles, 12-in., authorized, Ringwood to Enid, Okla. Completion date January 1952.

Oklahoma Natural Gas Co.—40 miles, 2-

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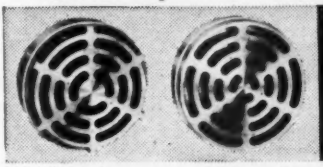

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36-in., authorized, Ringwood field gathering system. Completion date January 1952.

Pacific Gas & Electric Co.—44 miles, 8-in., under way, Salinas to King City, Calif.

Pacific Gas and Electric Co.—141 miles, 34-in., proposed, parallel sections along Topock-Milpitas line.

Pacific Gas & Electric Co.—10 miles, 10-12-in., authorized, Monterey to Fort Ord to Castroville; 12 miles, 16-in., Napa Wye to Shellville; 6 miles, 12-in., Cotati to Santa Rosa, Calif.

Pacific Northwest Pipe Line Co.—400 miles, 22-in., gathering lines on Texas Gulf Coast to Pacific Northwest pipe line.

Pacific Northwest Gas Pipe Line Corp.—3,175 miles, planned, Wharton County, Texas, via Oklahoma, Kansas, Fort Collins, Colo., to Portland, Ore., Tacoma and Seattle, Wash.

Panhandle Eastern Pipe Line Co.—70 miles, 24-26-in., under way, looping from Sneed, Tex., to Emporia, Kans.

Panhandle Eastern Pipe Line Co.—174 miles, 30 and 26-in., contracted, Tuscola, Ill., eastward—looping present system; R. A. Conyes, contractor, 44 miles, 26-in., Edgerton, Mich.; Anderson Bros.: 23 miles, 30-in., looping in Tuscola, Ill.; 45 miles, 30-in., looping in Montezuma, Ind.; 63 miles, 30-in., looping in Zionsville, Ind.

Pennsylvania Gas Co.—53 miles, 12-in., between Warren and Erie, Pa. (Sect. 1—17 miles, under way and contracted by Harford Bros. Sect. 3—25 miles.

Peoples Natural Gas Co.—25 miles, proposed, Cambria and Blair counties, Pennsylvania.

Phillips Natural Gas Co.—20 miles, 8-in., under way, Blue Lake to Chocolate Bayou, Tex. 10-51 completion date.

Phillips Petroleum Co.—118 miles, 3-22-in., under way, Sherman and Hansford counties, Texas gas-gathering system; Vaughn & Taylor Construction Co., Inc., Dumas, Tex., J. F. Crawford, spreadman at Texhoma, Okla.

Piedmont Natural Gas Co.—38 miles, 6-in., proposed, North Carolina—laterals from transcontinental gas system.

Prince George's Gas Corp.—20 miles, 22-in., authorized, between Chillum and Rockville, Md.

Public Service Co. of North Carolina.—33 miles, 10-in., authorized, Burlington to Chapel Hill, N. C., completion date 3-1-52; 16 miles, 8-in., authorized, Chapel Hill to Raleigh, N. C., completion date 7-1-52; 29 miles, 4-in., authorized, Statesville to Kanapolis, N. C., completion date 7-1-52; 83 miles, 6-in., authorized, Kings Mountain to Asheville, N. C., completion date 3-1-53.

Rockland Light & Power Co.—22 miles, 8-in., proposed, Orangetown to Tompkins Cove, N. Y.

Southern California Gas Co.—35 miles, planned, Antelope Valley, California.

Southern California Gas Co. and **Southern Counties Gas Co.**—36 miles, 6-8-in., contracted, Palmdale to Mojave, Calif. Alex Robertson Co., contractor, E. C. Neal, spreadman at Lancaster, Calif., completion date 11-1-51.

Southern California Gas Co., and Southern Counties Gas Co. of California.—81 miles, 30-in., proposed, Whitewater to Desert Center, Calif.

Southern California Gas Co.—24 miles, 30-in., under way, Inglewood to San Ferdando Valley, California. Alex Robertson Co., contractor. Completion date 11-51.

Southern Natural Gas Co.—21 miles, 24-in., authorized, Perryville Station, La., to Boeuf River.

Southern Natural Gas Co.—14 miles, 24-in., authorized, Onward Station, Miss., to Big Sunflower River.

Southern Natural Gas Co.—14 miles, 14-in., authorized, Perryville Station, La., to Wilhite Gate.

Southern Natural Gas Co.—375 miles, 24-in., planned, Gwinville, Miss., to Atlanta, Ga.

Southern Natural Gas Co.—160 miles, proposed loops, Ouachita Parish, Louisiana, to Augusta, Ga.; 20 miles in Ouachita Parish; 13 miles in Ouachita and West Carroll parishes; 7 miles, Sharkey County, Mississippi; and 106 miles, 14-in., Bass Junction to Augusta, Ga.

Southern Union Gas Co.—15 miles, 20-in.,

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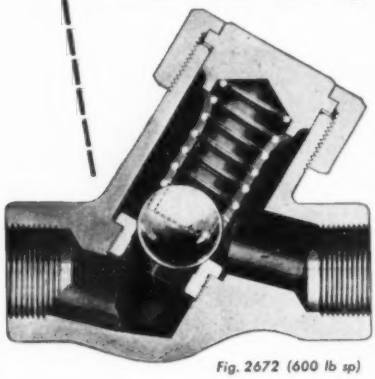

Fig. 2672 (600 lb sp)

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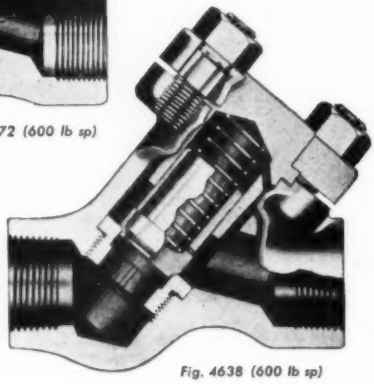

Fig. 4638 (600 lb sp)

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authorized, Albuquerque main line; 18 miles 12¾-in., San Juan County, N. M.; 10 miles, 8⅝-in., authorized, Clovis to Portales, N. M., completion date 12-51.

Southwest Gas Corp., Ltd.—26 miles, proposed, from P. G. & E. line to Victorville, Calif.

Sunray Oil Corp.—133 miles, 3-30-in., under way, system for Snyder gasoline plant. Vaughan & Taylor Construction Co., contractor. D. D. Vaughn, spreadman.

Tennessee Gas Transmission Co.—880 miles, 30-in., planned, first 150 miles of loops to be laid at Monroe, La., Greenville, Miss., Midland and Portland, Tenn.

Tennessee Gas Transmission Co.—420 miles, planned, looping on Buffalo and New England extensions.

Tennessee Gas Transmission Co.—304 miles, 24-in., proposed, between Mercer, Pa., and Utica, N. Y.; 528 miles, proposed loops; 200 miles, proposed, miscellaneous lateral lines.

Tennessee Gas Transmission Co.—158 miles, 30-in., under way, vicinity of Jones, La., on the north to near Cypress, Tex., on the south; Houston Contracting Co. Four spreads located as follows: North end work at Bastrop, Tex., W. H. Hayes and M. L. Thompson, superintendents; center section at Natchitoches, La., E. C. Norris and R. E. Thornton, superintendents; south end at Conroe, Tex., F. A. Silar, superintendent.

Tennessee Gas Transmission Co.—64 miles 26 and 30-in., loops, contracted, South Texas Oklahoma Contracting Co., contractor, field office, Falfurrias, Tex., Pano na Shiflett, superintendent.

Tennessee Gas Transmission Co.—136 miles 24-in., under way, Hamburg to Onondaga-Madison County line, N. Y.; H. C. Price, Auburn and Warsaw, N. Y., field offices. G. A. Reutzel and R. K. Shivel, spreadmen.

Tennessee Gas Transmission Co.—120 miles 24-in., under way, Hamburg to Hudson River; Bechtel Constructors, Inc.; Richfield Springs, N. Y., project office, R. L. Bowman and W. N. Molander, superintendents.

Tennessee Gas Transmission Corp.—413 miles, 26-30-in., authorized, loop line along presently authorized system.

The Texas Co.—27 miles, 8-in., authorized, Ventura to Filmore, Calif.

Texas Eastern Transmission Corp.—791 miles, 30-in., under way, Kosciusko, Miss., to Connellsville, Pa.

Texas Eastern Transmission Corp.—50 miles, 30-in., under way, Ohio River to Vanceburg, Ky. Trojan Construction Co., Inc., contractor. Charles Tillotson, spreadman at Winchester, Ky.

Texas Eastern Transmission Corp.—76 miles, 30-in., under way, Florence, Ala., to Columbia, Tenn. Eastern Pipeline Contractors, Cliff Simmons, spreadman at Florence, Ala. Completion date 10-31-51.

Texas Eastern Transmission Corp.—79 miles, 30-in., under way, Cumberland River to Columbia, Ky. Oman Construction Co., contractor. William Smith, superintendent and Floyd Hudnell, spreadman at Columbia, Ky.

Texas Gas Transmission Corp.—35 miles 12-in., authorized. Slaughters, Ky., to Evansville, Ind.

Texas Gas Transmission Corp.—189 miles 26-in., authorized, Acadia Parish to connection with existing facilities in Morehouse Parish.

Texas Gas Transmission Corp.—195 miles 26-in., proposed, Gulf Coast region to southwestern Louisiana.

Texas Gas Transmission Corp.—425 miles 26-in., proposed, looping from Bastrop, La. to Hardinsburg, Ky.

Texas Gas Transmission Corp.—181 miles 26-in., under way, Bastrop to Eunice, La. Houston Contracting Co. (North spread near Beekman, 65 miles south to Grayson, La., W. H. Hayes, supt.; center spread north side of Red River at Pineville, 60 miles north to Grayson, E. C. Norris, supt., south spread, south side of Red River, 56 miles south to Tepetate field near Eunice, F. A. Silar, supt.).

Texas Gas Transmission Corp.—580 miles 26-in., proposed, Louisiana and Kentucky.

Texas Illinois Natural Gas Pipeline Co.—300 miles 30-in. under way, Corpus Christi area to Joliet, Ill.

Texas-Illinois Gas Pipe Line Corp.—300

miles, 30-in., under way; Trinity River to Texarkana; H. C. Price, contractor. C. E. Shivel, spreadman at Carthage; C. R. Ice spreadman at Nacogdoches.

Union Gas & Electric Co.—35 miles, 8-in. Bloomington to Harris, Ill. O. R. Burden contractor. Floyd Lewis, spreadman at Bloomington, Ill., Fall completion date.

Union Oil Co. of California.—40 miles, 8-10-in., planned, San Joaquin Valley and Los Angeles Basin.

United Fuel Gas Co.—32 miles, 20-in., under way, Lanham to Broad Run, W. Va. H. L. Gentry Construction Co., contractor. Frank Morris, spreadman at Charleston, W. Va.

United Gas Pipe Line Corp.—315 miles, 24-30-in., contracted, Agua Dulce to near Goodrich, Tex. Oklahoma Contracting Co., contractor.

United Gas Pipe Line Corp.—53 miles, 24-in., authorized, Texas; 93 miles, 20-24-26-in., authorized, Houston, Beaumont, Orange, Tex.

United Gas Pipe Line Co.—50 miles, 18-in., authorized, Baldwin County, Alabama, southeasterly to Escambia County, Florida.

United Gas Pipe Line Co.—100 miles, 20-24-26-in., contracted, Near Houma to Franklin, La.; Associated Pipe Line Contractors, Inc.

United Gas Pipe Line Corp.—510 miles, 24-26-30-in., contracted, Agua Dulce, Tex. to Monroe, La.; 233 miles, 20-24-26-30-in. from Pure Oil Co.'s offshore platform Block 32 Eugene Island area to Jackson, Miss., comp. sta.; 60 miles, 12-16-20-in., from Lafayette comp. sta. and Weeks Island field to Franklin, La., to connect with above-mentioned 30-in.; 59 miles, 30-in., Jackson comp. sta., Miss., to Texas Eastern Trans. Corp.; 124 miles, Sterlington comp. sta. near Monroe, La., to Jackson comp. sta., Miss.; 23 miles, 8-12-16-in., South Louisiana facilities; all contracted by Gulf Southern Contractors, a joint venture including Texas Louisiana Contractors; Oklahoma Contracting Co.; J. Ray McDermott and Morrison Knudson. Inspection by Brown & Root, Inc.

United Gas Pipe Line Co.—30-in., contracted, Gonzales, La., to Koscuisko, Miss. River Const. Corp. Completion date 11-51.

United Gas Pipe Line Co.—24-in., contracted, Baxterville, La., to McComb; River Construction Corp. Completion date 11-51.

United Gas Pipe Line Co.—65 miles, 30-in., under way, Gonzales, La., to Koscuisko, Miss. River Const. Corp. Red Tatum, spreadman at Hammond, La. Completion date 11-51.

United Gas Pipe Line Co.—43 miles, 24-in., under way, Baxterville, La., to McComb, Miss. River Const. Corp. Jim Reed, spreadman at Columbia, Miss. Completion date 11-1-51.

United Gas Pipe Line Co.—87 miles, 20-in., under way, State Line to Jackson, Miss. River Const. Corp. Merle Tatum, spreadman at McComb, Miss. Completion date 12-15-51.

U.S.E.D.—18 miles, 8⅝-in., contracted, Norwalk to Long Beach, Calif. J. E. Young Pipeline Contractor, Inc.

Utah Natural Gas Co.—360 miles, 22-in., proposed, San Juan Basin area to Salt Lake Utah.

Virginia Natural Gas Co.—183 miles, Buckingham to Richmond and Portsmouth, Va.

Western Kentucky Gas Co.—2 to 4-in., under way, additions to present system. Modern Welding Co., Inc., contractor.

Western Pipe Lines.—1,300 miles, 22-in., planned, Southern Alberta to Duluth, Minn.

West Texas Gas Co.—27 miles, 10-in., authorized, Lubbock to Abernathy, Tex.

Foreign Crude-Oil Pipe Lines—Planned and Under Way

Alberta Pacific Oil Pipe Line Co. (Brokaw, Dixon, McKee).—970 miles, 16-in., proposed, Edmonton south to Kingsgate B. C., to Washington to Vancouver, B. C.

Cia. de Petroleo Ganso Azul, Ltd.—40 miles, 4-in., planned, Ganso Azul field to Pucalpa on upper Ucayali River, Peru.

Condor S.P.A. (Shell).—80 miles, planned Genoa to Rho, near Milan, Italy.

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feros Fiscales.—409 miles, under way, Plaza Huincul to Bahia Blanca, Argentina.

Independent Pipe Line Co.—721 miles, 16-18-22-in., proposed, Edmonton to Vancouver. Spreads as follows: 185 miles of 22-in.; 391 miles, 20-in.; 93 miles, 16-in.; and 30 miles, 18-in.

Iraq Petroleum Co., Ltd.—556 miles, 30-32-in., under way, Kirkuk, Iraq, to Banias, Syria, 1952; Bechtel-Kirkuk, contractor.

Iraq Petroleum Co., Ltd.—72 miles, 12¾-in., Zubair to Fao. Arabian Bechtel Co., contractor. Completion date 12-51.

Middle East Pipelines, Ltd.—800 miles, 34-36-in., planned, Iran to a Levantine port.

Petroleos Mexicanos.—145 miles, 12-in., considered, 18 de Marzo field via Reynosa to Monterrey, Mexico.

Petroleos Mexicanos.—100 miles, planned, Isthmus of Tehuantepec, Jose Colomo to El Plan field, Minatitlan.

Shell Caribbean Petroleum Co.—160 miles, 30-in., under way; Palmarejo to terminals on the Paraguana Peninsula (Cardon and Las Piedras, Venezuela), 4-52. Land sections contracted by Williams Brothers, de Venezuela, S. A., Charles P. Williams, manager, Marvin E. Jones, superintendent. Water crossings contracted by Mahoney Contracting Co.

Texas Petroleum Co.—60 miles, 4-6-in., under way, Pto. Nino to La Dorada.

Trans-Mountain Oil Pipe Line Co.—718 miles, proposed, Edmonton, Alta., to Vancouver, B. C. Canadian Bechtel, Ltd., engineers.

Winnipeg Pipe Line Co., Ltd.—75 miles, 10-in., under way, Gretna to Winnipeg, Manitoba; Sparling-Fowler Co., Ltd.

Foreign Products Pipe Lines—Planned and Under Way

Colombia Ministry of Petroleum.—90 miles, 8-in., planned, Puerto Berrio to La Dorada, Colombia.

Colombia Ministry of Petroleum.—113 miles, 6-in., contracted, Puerto Berrio to Acededo near Medellin, Colombia. Carolina Construction Co.

Colombian Ministry of Petroleum.—70 miles, 4-in., planned, Buena Ventura to Cali, Colombia.

Empresa de Ferrocarriles Ecuatorianos.—50 miles, 4-in., under way, Guayaquil to Palmira, Ecuador. J. A. Jones, contractor; C. R. C. Engineering Co., engineers.

Estrada de Ferro Santos a Jundiai.—88 miles, 18-in., under way, Santos to Sao Paulo, Brazil (fuel oil line); Techint, contractor. Completion date 12-51.

Governments of Southern Rhodesia and Portuguese East Africa.—200 miles, considered, Beria, Portuguese Mozambique to Umtali, Southern Rhodesia.

Imperial Oil Co., Ltd.—195 miles, 10-12-in., planned, Sarnia via London, Hamilton to Toronto, Ont., Canada.

Petrocongo (Sub. Cie. Financiere Belge des Petroles, S. A.).—225 miles, considered, Ango-Ango to Leopoldville, Belgian Congo.

Petroleos Mexicanos.—185 miles, 16-in., under way, Minatitlan to Salina Cruz, Mexico.

Societe des Transports Petroliers par Pipe Line.—140 miles, 10-in., under way, Le Havre to Paris, France. Entrepose, contractor. Completion date 1952.

State of Cundinamarca, Colombia.—120 miles, 6-in., Puerto Salgar, to Bogota, Colombia; Williams Brothers Corp., David Louthen, manager, Bogota.

Trans-Northern Pipe Line Co.—400 miles, proposed, Hamilton, Ont., to Toronto, Ont., to Montreal, Que., Canada.

Foreign Natural-Gas Pipe Lines—Planned and Under Way

Azienda Generale Italiana Petroli.—110 miles, 12-14-16-in., planned, Cortemaggiore to Genoa.

Azienda Generale Italiana Petroli.—110 miles, planned, Cortemaggiore to Bologna.

Azienda General Italiana Petroli.—160 miles, 14-16-in., under way, Cortemaggiore to Torino. Completion date 1951.

Canadian Western Natural Gas Co., Ltd.—27 miles, 8-in., under way, Jumping Pound to Exshaw, Alberta. Company crews. Completion date 10-51; 22 miles, 6-in., under way, Exshaw to Banff. Company crews. Completion date 10-51.

Canadian Delhi Oil Co. (Subsidiary Delhi Oil Co.).—2,132 miles, proposed, Alberta, Toronto, Montreal.

Direccion General del Gas del Estado.—310 miles, 8-in., under way, Plaza Huincul to Neuquen, Argentina, to the vicinity of General Conesa, Argentina.

Northwest Natural Gas Co.—950 miles, 26-in., planned, Alberta fields to Vancouver, B. C., Seattle, Wash., and Portland, Ore.

Northwestern Utilities, Ltd.—35 miles, 16-in., authorized, Viking to Shonts, Alberta.

Petroleos Mexicanos.—205 miles, 16-in., considered, Monterrey to Torreon, Mexico.

Petroleos Mexicanos.—260 miles, 20-in., under way, Monterrey to Tampico and Poza Rica, Mexico.

Petroleos Mexicanos, Mexican Gas Co., and Industrial Gas Co.—600 miles, planned, Reynosa, Tamaulipas, to Tampico-Poza Rica, Mexico.

Trans-Canada Pipe Lines, Ltd.—Proposed, Alberta to Toronto and Montreal.

Venezuela Atlantic Transmission Corp.—195 miles, 10-12-16-in., under way, El Placer near Las Mercedes, State of Guarico to Caracas, La Guaira, Maracay, and Valencia. Contracted by Williams Brothers, de Venezuela, S. A., B. E. Barnes, manager.

Westcoast Transmission Co., Ltd.—1,110 miles, 24-in., planned, Dawson Creek, B. C., through Pine Pass and Fraser River Valley to Kamloops, Princeton, and Vancouver to Portland. Ford, Bacon, and Davis, engineers.

Westcoast Transmission Co., Ltd.—280 miles, 20-in., planned, Pincher Creek to Montana on to Spokane, Wash. Ford, Bacon, and Davis, engineers.

Western Pipe Lines.—1,200 miles, 22-in., planned, southern Alberta, Winnipeg, to Duluth, Minn.

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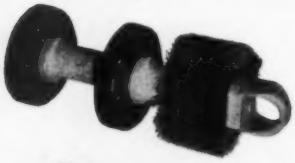

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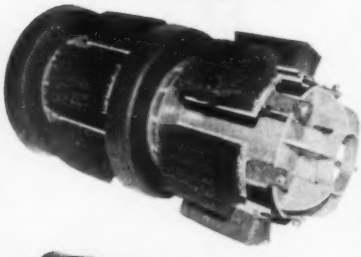

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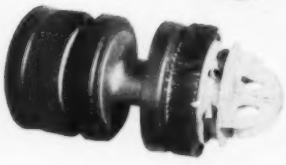

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WRITE FOR COMPLETE INFORMATION

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PIPE LINES

Panhandle Progress

Looping, new compressor facilities near completion

KANSAS CITY. — Panhandle Eastern Pipe Line Co. will complete a major part of its pipe-line expansion program late this month.

Additional capacity in the form of pipe-line loops and additional compressor equipment is being installed to deliver an additional 50 million cubic feet per day to Panhandle's customers from its sources of supply in southwestern Kansas, Oklahoma and Texas Panhandle.

West of Tuscola.—This program involves the installation of 114.24 miles of 26-in. by $\frac{5}{16}$-in. loop laid in nine segments between Hansford compressor station, in Hansford County, Texas, and Tuscola compressor station, in Douglas County, Illinois.

In addition, 1,600-hp. compressor units are being installed at Olpe compressor station, in Lyon County, Kansas, and Houstonia compressor station, in Pettis County, Missouri. A new field booster station of 4,000 hp. is being constructed near Guymon, Okla.

East of Tuscola. — East of Tuscola Compressor Station, facilities are being constructed to receive 250 million cubic feet per day from Trunkline Gas Co. and for delivering this volume and the additional 50 million cubic feet per day from Panhandle's own sources to Panhandle's customers.

This combined program comprises the installation of 136.34 miles of 30-in. by 5/16-in. loop in 3 sections, 61.2 miles of 26-in. loop in 2 sections; an 8,000-hp. addition to Tuscola Station; a 6,000-hp. addition to Zionsville Station, and an 8,000-hp. addition to Edgerton Station. All of these facilities will augment main-line capacity.

Michigan lateral. — In addition, 10.2 miles of 26-in. by 5/16-in. loop was constructed to increase the deliverability of the Michigan lateral system; and 14.4 miles of 20-in. by ¼-in. loop was installed to increase the deliverability to Ohio customers.

Completion of the major part of this construction program this month, means that the combined capacity of the Panhandle Eastern and Trunkline systems will deliver 850 million cubic feet per day to its customers.

Pipe Liners to Participate In Diesel Power Conference

STILLWATER, Okla.—The Diesel Power Plant Operators conference of the Oklahoma Institute of Technology to be held at Oklahoma A. and M. College here, October 22-25, will feature several papers delivered by pipeline and oil-company engineers.

Papers include "Safety Practices in Diesel Power Plants," Holley Bradley, Service Pipe Line Co.; "Care and Maintenance of Diesel Engine Power Plant Instruments," J. M. Ribble, Phillips Petroleum Co.; and "Crankcase Explosions" by G. W. Ferguson, The Texas Co. Fay Cooke, Service Pipe Line Co., and Ferguson will participate in a panel discussion on trouble shooting.

In recent years the majority of conference attendees have come from pipe-line companies and oil companies in Oklahoma and Kansas.

Texas-Illinois Schedules Opening of Big Gas Line

HOUSTON.—With but 35 miles to go on the 30-in. 1,331-mile Texas-Illinois Natural Gas Pipeline Co. line from the Texas Gulf Coast to Joliet, Ill., an official opening date is being planned for early in December.

Mark V. Burlingame, vice president in charge of operations, Texas-Illinois Natural Gas Pipe Line Co., said that testing has been going on as the sections have been completed, and the line will be ready for use a few days after the last pipe section is welded. Pipe for the remaining section is already on railroad cars and when that is laid and some remaining work at the Mississippi River crossing completed, the line will be ready to go, he said.

The system gathers gas from the La Gloria, Old Ocean, Chocolate Bayou and other fields and carries it to Joliet, Ill., where it enters a distribution system serving the Chicago area. The line will have an initial capacity of 374,000 M.c.f. per day with an eventual capacity of 524,000 M.c.f. daily.

Phillips Transfers Operation Of Big Products Pipe Line

BARTLESVILLE, Okla.—Operation of the Borger, Tex.-to-Chicago products pipe line has been transferred by Phillips Petroleum Co. to Phillips Pipe Line Co.

Phillips Pipe Line will continue to operate the crude oil system which was transferred in recent years from Standish Pipe Line Co., no longer active.

Some products-pipe-line operations are being conducted in connection with refining facilities of Phillips Petroleum Co. and Phillips Oil Co.

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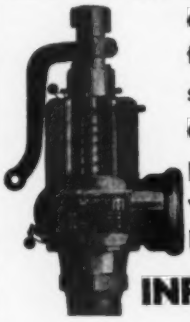

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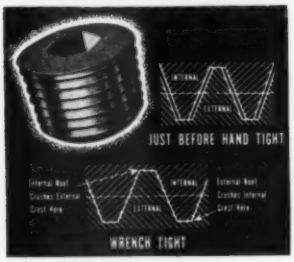

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Phillips Petroleum Co. in connection with gasoline plants. Phillips Natural Gas Co. operates a 15-mile gas system of 4 to 16-in. pipe in the vicinity of Bethany and Packingtown, suburbs of Oklahoma City, and the recently completed Blue Lake—Chocolate Bayou, Tex., 20-mile 8-in., gas line in the Houston area.

Legal Block to New England Gas Line Removed by Judge

NEWARK, N. J.—A legal block to construction by Algonquin Gas Transmission Co. of 61 miles of natural-gas pipe line from Texas Eastern Transmission Corp.'s Big Inch to New England was removed last week by a ruling of a superior court judge here.

The judge, Daniel J. Brennan, ruled against a motion by a township and various property owners contesting condemnation proceedings on grounds that the company failed to meet statutory requirements.

Behind the technical issues were scattered objections by residents of several municipalities in five counties through which the pipe-line right-of-way passes. Northeastern has already obtained easements for a majority of the property owners in most of the counties.

New Radio Permits Issued

WASHINGTON. — The Federal Communications Commission has issued authorizations for 20 base stations, 1 fixed station, and 156 mobile units, as follows:

Interstate Petroleum Communications, Inc.: 6 base stations at temporary locations to be used in Montana, Wyoming, Utah, Colorado, New Mexico, Washington, Oregon, Idaho, Nevada, Arizona, and California, and 60 mobile transmitting units—all to operate on 48.57 mc.

Michigan-Wisconsin Pipe Line Co.: Control station on 1,860, 1,920, and 1,980 mc.

United Gas Pipe Line Co.: Base station at Burn, La., on 48.78 mc.

Humble Pipe Line Co.: Base station at Alanreed, Tex., on 48.86 mc.

Pan American Refining Corp.: 21 mobile units on 153.05 mc. in the Texas City, Tex., area.

American Petroleum Co.: 6 base stations near East Village Mills, Sour Lake, Hall, Spurger, Arriola, and Silsbee, Tex., and 15 mobile units — all on 153.17 mc.

Pipe-Line Briefs

Pipe-line runs of crude oil in Kansas reached an all-time high in August, according to the state conservation division. Average runs during the month were 316,567 bbl. daily, an increase of 6,567 bbl. a day over the current allowable. The previous mark for the state was 309,953 bbl. per day in May of this year. The division estimated runs for the week ended September 17 at 329,756 bbl. daily, up 22,321 bbl. a day from the previous week's estimate. This is 19,756 bbl. daily above the allowable.

A bill which would prohibit construction of new oil pipe lines or extensions of old ones without prior certificates of public convenience and necessity from the Interstate Commerce Commission has been introduced in Congress. The measure, introduced by Rep. McGrath (D., N. Y.) has been referred to the House interstate and foreign commerce committee for action. Committee sources doubt that anything will be done with it in view of the limited time remaining before Congress adjourns.

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NATURAL GAS

Conversion to Natural Gas In New England Under Way

BOSTON. — Natural gas is now coursing through mains to domestic users in New England.

Northeastern Gas Transmission Co. is piping gas through its main and lateral lines in most of the territory to be served in Massachusetts, and about 75 per cent of the customers it plans to serve can have gas as fast as burners are converted to handle it.

Northeastern, an affiliate of Tennessee Gas Transmission Co., is building a $28,000,000 distribution system in New England.

Natural gas first became available in the Northeast 2 weeks ago when Springfield Gas Light Co. made the changeover from the manufactured product.

Worcester Gas Light Co. expects to convert to 100 per cent natural before the end of the month. Holyoke Gas Light Co. started changing over last week and plans to finish up October 21. Pittsfield Gas Light Co. will begin conversion soon.

Use of natural gas in the Northeast was delayed by a dispute over rates between Northeastern and the Federal Power Commission. The company originally proposed a rate of 44 cents per M.c.f. and later applied for FPC approval of a 53-cent rate. The commission wouldn't go along with the 9-cent boost, but did authorize a 2-cent increase.

Arkansas Louisiana to Take Gas From Haynesville Field

SHREVEPORT. — Arkansas Louisiana Gas Co. has contracted with Joe B. White, Vincent Hughes, and associates for gas from approximately 19 wells in Haynesville and East Haynesville fields of Claiborne Parish, Louisiana.

Contract calls for payment of 10 cents per M.c.f. initially with provision for an ultimate increase to 13 cents. Most of the producing properties under contract have not yet been connected.

Work has already started on a gathering system from the wells to a dehydrating plant at Haynesville, La. In addition Arkansas Louisiana has applied for permission from the Federal Power Commission to build about 16½ miles of 8⅝-in. line from Haynesville to Arkansas Fuel Oil Co.'s Columbia gas-processing plant near Magnolia, Ark. The gas would then be processed and sent through Arkansas Louisiana's main lines to customers in central Arkansas.

If authorized, the new line will be used as a system with two other lines, 6 and 8-in., paralleling it from Haynesville to the Columbia plant. The new line would increase capacity of this system from its present 40,000,000 cu. ft. per day to 80,000,000 on peak days.

United Fuel Begins Work On Lanham Storage Project

CHARLESTON, W. Va. — United Fuel Gas Co., of this city, has commenced construction of its Lanham underground-storage plant. The firm will construct 45 miles of natural-gas pipe line, a 2,640-hp. compressor station, and a dehydration plant.

A 1,000-hp. gas-engine unit will be transferred from the company's Walgrove station to its Kanawha station.

United Fuel Gas Co. operates 10 storage pools located in shallow, depleted gas fields. It plans to acquire and place in operation three additional storage pools in Putnam and Kanawha counties.

Texas' July Gas Production Well Over July 1950 Figure

AUSTIN. — Production of natural gas in Texas during July climbed to 379,385,909 M.c.f., an increase of more than 9,000,000 cu. ft. over the total in June and more than 15 per cent above production in July 1950, according to the Texas Railroad Commission.

Net production for market totaled 307,327,837 M.c.f., an increase of 20.84 per cent over marketed production in July last year.

Transmission lines took 57.34 per cent of all gas produced, up 25.45 per cent from last year. Disposition of the remainder was as follows: Extraction loss (plants), 3.57 per cent; plant fuel and lease use, 7.82 per cent; gas lift, 3.75 per cent; pressure maintenance and repressuring, 6.28; recycled, 12.71; carbon black, 7.12; vented and line loss, 1.41.

Volumes going into underground storage are included in the commission's heading, "transmission lines," until such time as they become large enough to warrant a separate heading.

Waterloo Storage Wells to Be Operating in December

ST. LOUIS.—Mississippi River Fuel Corp. of this city plans to place in operation by December 1951 facility wells in its underground-storage project in the old Waterloo oil field of Monroe County, Illinois. Total cost is estimated at $1,900,000.

Using 25 facility wells and an expected storage capacity of 13.2 billion cubic feet, operators plan to obtain a daily deliverability of not less than 100,000 M.c.f.

Last August, the Federal Power Commission deferred until June 2, 1951, construction of a 24-in. line and a dehydration plant to serve the project.

The Waterloo project, located about 15 miles south of here, will be employed to store during the summer months large quantities of natural gas received from Louisiana field sources and is expected to improve the company's ability to meet peak-day requirements in the St. Louis-market area.

Northern Natural Seeking Imports of Canadian Gas

OMAHA. — Northern Natural Gas Co. has negotiated a preliminary agreement with Western Pipe Lines of Canada for imports of gas from Canada, subject to approval of Canadian Government.

John Merriman, Northern president, said, however, that it was doubtful that the company could complete construction of a pipe line across the border before the fall of 1953, even if the Alberta Conservation Board declares that an ample supply of gas is exportable.

If permitted, Western would deliver to Northern at the border more than 1,000,000 cu. ft. of gas per day.

Natural Gasoline

Sulfur Unit Planned for Slaughter Gasoline Plant

FORT WORTH. — Stanolind Oil & Gas Co., operator and part owner of Slaughter gasoline plant near Sundown, Tex., has revealed that a sulfur-recovery unit will be built at the plant for the extraction of approximately 40 long tons of sulfur per day from 8,500,000 cu. ft. of acid gas.

John R. Evans, manager of Stanolind's North Texas-New Mexico division, said Fluor Corp., Ltd., of Los Angeles, will install the unit. It has been approved by the Petroleum Administration for Defense, Evans said, and is expected to be in operation by March 1952.

Owners of Slaughter plant in addition to Stanolind are The Texas Co., Honolulu Oil Corp., Magnolia Petroleum Co., Devonian Co., Atlantic Refining Co., Saltmount Oil Co., and Mid-Continent Petroleum Corp.

The plant now recovers butane, propane, and natural gasoline from about 90,000,000 cu. ft. per day of casing-head gas produced with oil from Slaughter field.

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Among the Drilling Contractors

Union Sulphur Breaks Fast Drilling Records

The world's record for fast drilling claimed recently by a Humble Oil & Refining Co. crew in the Lake Sand field, in South Louisiana, has been exceeded in a well completed by Union Sulphur and Oil Corp. in the South Roanoke field, Jefferson Davis Parish, also in South Louisiana.

Humble's crew in the Lake Sand well made 2,575 ft. of hole during one regular 8-hour tour, averaging 322 ft. per hour. The new record established in the Union Sulphur well was 2,705 ft., exceeding the previously reported record by 130 ft., and averaging 353 ft. per hour. Actual drilling time in the latter well was 7 hours and 40 minutes.

Both records were made in 9⅞-in. hole at comparable depths with Humble's footage being from 1,910 to 4,485 ft. and Union Sulphur's from 1,881 to 4,586 ft. Footage in both cases was made with jet-type bits. Union Sulphur employed a 19-in. by 73/4-in. by 20-in. mud pump, operating at 60 strokes per minute under 1,300 psi. pressure. Rotary speed was 200 r.p.m. Maximum hole deviation was 1¾° at 3,900 ft.

Union Sulphur's well, 1-A Meleck Unit, was completed at a total depth of 10,020 ft., drilled in 11 days, or an average of 911 ft. per day, from spudding date, which the company also believes to be a record for fast drilling for wells to that depth.

George & Wrather Drilling Co., Mt. Carmel, Ill., is drilling a Dakota sand exploratory test for National Associated Petroleum Co. at 1 State, NE NW SE 36-9s-66w, on the West Cherry prospect, in Douglas County, Colorado.

Fortenberry Drilling Co., Natchez, Miss., is starting another well for Humble Oil & Refining Co. in the newly opened Wilcox sand field at Cowpen Point, 5 miles north of Natchez, Adams County, Mississippi. The new operation is 1,100 ft. northeast of the discovery well, which found the Wilcox sand productive in a zone at 5,287-95 ft.

Gabbert & Jones Drilling Co., Wichita, Kans., is drilling for Deep Rock Oil Corp. at 1 School Land, SE SW NE 26-9n-50w, a wildcat northwest of Fleming, Logan County, Colorado.

George Acuff Drilling Co., Casper, Wyo., has moved a light rig to the Bud Kimball area in Washakie County, Wyoming, where it has the contract for a 2,500-ft. test to be drilled for Hope & Phenix at 1 Government, NE NE NW 4-45n-88w.

Thompson & Harris Drilling Co., Cushing, Okla., is starting a projected 3,200-ft. test for Toklan Production Co. at 1 Cowen, NE NE SW 34-14n-7e, a wildcat in the West Arno area, Creek County, Oklahoma.

Arrow Drilling Co., Tulsa, has a new operation under way for The Texas Co. in the Oletha field, Limestone County, eastern Texas, where it is drilling 1 Cox, in the Juan Luis Chavert Survey.

Barbour Drilling Co., Tulsa, is moving a rig to a rank wildcat location 1½ miles north of Beaver, in Beaver County, Oklahoma Panhandle, where it has contracted with Flynn Oil Co. for a test to a projected depth of 6,250 ft. Location is on state land in the SE SE SE 35-5n-23eCM.

Fred Wimberly Drilling Co., Tyler, Tex., has a new operation under way for R. W. Fair in the Walter Fair field, Kaufman County, East Texas. Latest test is 2 Wilkerson, in the David F. Webb Survey.

Glasscock Drilling Co., Shreveport, La., has moved in for a wildcat test to be drilled for Carter-Gragg Oil Co. at 1 Kent, Robert Caradine Survey, 4½ miles southeast of Eureka, Navarro County, East Central Texas.

Jordan Drilling Corp., Houston, is drilling for E. D. Markham at 1 Kangerga, Larkin Caison Survey, in the Stegall field, 14 miles southwest of Henderson County, Rusk County, eastern Texas.

Williams-Copeland, Inc., Tulsa, has the contract for a wildcat test which Midstates Oil Corp. will drill on its Hall lease in the SE NW NW SE 14-23n-3w, Garfield County, Oklahoma.

Butler-Johnson Service Corp., Shreveport, La., is starting a Pettit lime test for Mid-Century Oil & Gas Co. of Houston at 1 Williams, in 7-13n-15w, 2 miles north of Longstreet, De Soto Parish, Louisiana.

Milton Crow, Inc., Shreveport, La., has been awarded contracts for two Wilcox exploratory tests which Barnett Serio of Natchez, Miss., has projected in Concordia Parish, eastern Louisiana. One of the tests will be on the operator's Wild lease, 3¾ miles

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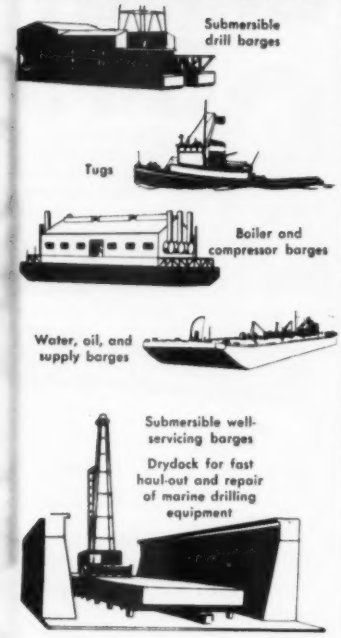
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southwest of Wildsville, with location in the C SW SW 7-7n-7e. The other will be located on the Ford lease, ¾ mile northeast of Monterrey, in the C SE SW 25-6n-7e.

W. C. Curry, Oil City, La., has a contract for a 5,000-ft. test to be drilled for C. R. Schuster at 1 Smith, C NW SW NE 7-17n-15w, north of the Greenwood field, Caddo Parish, northwestern Louisiana. Projected depth is 1,200 to 1,500 ft. below the depth of present producing zones in the field.

Earl Harter Drilling Co., Shreveport, La., has the contract for a projected 4,500-ft. test to be drilled for N. B. Hunt Co. at a wildcat location ¾ mile east of Montgomery, Grant Parish, Louisiana. Location is for 1 International, in 20-8n-4w.

Johnson & Flesher Drilling Co., Oklahoma City, contracting for Mid-Continent Petroleum Corp., is starting a Prue sand test 1¾ miles northwest of the West Davenport pool, 3 miles east of Chandler, Lincoln County, Oklahoma. Projected depth is 3,700 ft. Location is on school land in the NE NE SW 36-15n-4e.

Scat Drilling Co., Drumright, Okla., is drilling on a 4,700-ft. contract with Skiles Oil Corp., at a wildcat location 1½ miles south of Morrison, Noble County, Oklahoma. The test, 1 Eager, NW SW NW 30-21n-3e, will explore the Wilcox sands.

Kemp Drilling Co., Inc., Shreveport, La., has a 7,000-ft. contract for a Wilcox exploratory test which Sun Oil Co. has projected in Amite County, Mississippi. Location at 1 Tynes, C NE SE 18-4n-4e, is southeast of the Zion Hill townsite.

Lyle Cashion, Inc., Jackson and Laurel, Miss., has a rig running at a wildcat location 3 miles northeast of Rosette, Wilkinson County, southeastern Mississippi, where it is drilling for Max B. Andreae. Location is in the C NE NE 10-4n-1e. Contract is for 7,250 ft.

ACTIVE ROTARY RIGS*

(United States and Western Canada)

Area—	Week ended 10-8-51	Change week ended 10-1-51	Change week ended 10-9-50
Gulf Coast	601	+ 2	+ 78
W. Tex.-N. M.	992	+13	+210
Ark.-N. La.-E. Tex.	172	+ 8	+ 30
Oklahoma	336	+16	+ 49
Kansas-S. Nebraska	190	— 4	+ 59
Illinois-Eastern	158	+ 3	+ 2
Rocky Mountain	201	+ 3	+ 82
Pacific Coast	178	— 2	+ 38
Total U. S.	2,828	+39	+548
Western Canada	165	+ 6	+ 63
Total	2,993	+45	+611

*Courtesy Hughes Tool Co. Trends in drilling activity in the United States and the West Texas-New Mexico and Oklahoma-Kansas areas are shown on pages 190 and 191.

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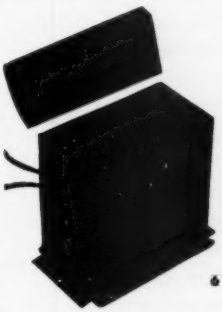

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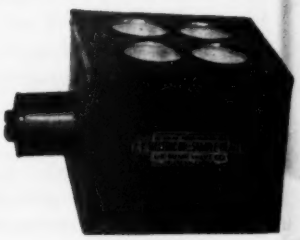

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REFINING

New Sunray Plant to Go On Stream Early in 1953

CORPUS CHRISTI.—The projected $10,000,000 new refinery to be built by Sunray Oil Corp. *(The Oil and Gas Journal, September 27, 1951, page 52)* probably won't be completed until the beginning of 1953, according to T. C. Bodley, head of the crude-purchasing and sales division.

Bodley has been making preliminary arrangements for construction of the 25,000-bbl. plant and has been attempting to secure right-of-way for building about 6.2 miles of pipe line from the refinery site to the existing Sunray crude pipe-line terminal. Negotiations have also been started to obtain 2½ million gallons of water daily from the city.

Bodley said engineering plans for the new plant will not be completed for a few months yet.

Bureau of Mines Releases Minerals Market Report

Sales of distillate fuels for heating last year represented a smaller percentage of total distillate sales than in any year since 1945, according to the survey by the Petroleum and Natural Gas Branch, Bureau of Mines. Data from this survey were released as Mineral Market Report No. MMS 2003.

Heating-oil sales accounted for 55.9 per cent of the total distillate market in 1950, compared with 57.8 per cent in 1949 and a postwar peak of 59.9 per cent in 1947. Sales of heating oils increased 16.1 per cent in 1950, but total movement of distillate to consumers in this country was up 20.1 per cent.

Distillate sales to railroads in 1950 represented almost an eighth of total distillate demand. In 1940 the railroads took only 2.0 per cent of the distillate marketed but have taken increasingly larger percentages each year to reach 12.3 per cent of the total in 1950. Last year's sales under this classification were 26.2 per cent greater than in 1949.

On the other hand, railroad purchases of residual fuel in 1950 dropped 4.1 per cent from the previous year to 11.0 per cent of the market compared with 12.8 per cent in 1949 and 20.6 per cent in 1946.

Sales of residual to smelters, mines, and manufacturing industries amounted to 148,111,000 bbl. in 1950 or 26.7 per cent of domestic demand for heavy fuel.

The largest market for home-heating distillates in 1950 was in District 1 with 59 per cent of total sales of distillate for heating.

Marketers in District 2 distributed 38 per cent of the distillate sold to railroads. Districts 3 and 5 accounted for almost 70 per cent of residual for railroads.

Military Oil Buyers to Ask Bids Soon on JP-4 Jet Fuel

WASHINGTON.—Bids will soon be asked by military oil buyers from refiners for large quantities of JP-4 jet fuel. No great difficulty is anticipated by the Petroleum Administration for Defense in obtaining sufficient quantities, according to that agency.

However, it is expected that spot difficulties may be encountered in some areas, particularly the West Coast. This is because of tighter specifications for JP-4 jet fuel and because of its composition, which is about 70-75 per cent gasoline fractions, 10-15 per cent kerosine fractions, and 10-15 per cent low-pour diesel fractions.

Over-all demands for the fuel will be adequately covered according to PAD observations.

Mid-West Refineries Hikes Alma, Mich., Plant Capacity

GRAND RAPIDS, Mich.—Completion of construction of a Platforming unit at Mid-West Refineries, Inc.'s Alma, Mich., refinery has rounded out an expansion and modernization program which has enlarged refinery capacity from the old 4,200 bbl. per day rate to 10,000 bbl. per day.

The company's expansion program was initiated after the purchase from Michigan-Ohio Pipeline Corp. of a 260-mile pipe line to carry crude from Toledo into Central Michigan.

New facilities were viewed by the public October 9 during an open house.

Site for New $50,000,000 Texas TEL Plant Inspected

HOUSTON.—The site of the new $50,000,000 tetraethyl-lead plant now under construction on the Houston Ship Channel was inspected by the board of directors of Ethyl Corp. this week.

The directors made the visit to inspect progress being made on the new facilities, construction of which is to be completed in the spring of 1952. The new plant will manufacture tetraethyl lead and other chemicals need-

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New Fuel Testing Manual

A complete new edition of the A.S.T.M. Manual of Engine Test Methods for Rating Fuels will be available in January, according to the American Society for Testing Materials.

The five standard methods for rating motor, aviation, and diesel-engine fuels will be outlined in their latest approved form. In addition the book will present supplementary material on operation and maintenance details, building and utility requirements, installation and assembly of the engines, and reference fuels.

Refining Briefs

Shell Chemical Corp. has arranged with Ralph M. Parsons Co., of Los Angeles, to build a sulfur-recovery unit at its Houston plant using waste refinery gases as feed. The new unit, certified by the Government as a necessary defense project, is expected to be in operation by the middle of 1952. The process will embody burning of the gases and catalytic conversion to sulfur at an annual rate of more than 13,000 tons.

The strike which has tied up Cities Service Oil Co.'s East Chicago, Ind., refinery for more than 2½ months was settled last week. A statement issued jointly by company and union officials said satisfactory agreement has been reached on all issues, including rates of pay, procedures for handling overtime, and adjustment of inequities. Schedules will be made up immediately and employes will be called back to work as rapidly as possible.

Standard Oil Co. (Ind.) has started commercial shipment of benzene from its newly completed plant at the company's Whiting, Ind., refinery. Plans are now being made to expand the plant. Present facilities, which now can produce about 11,000,000 gal. of benzene per year, will be expanded to produce about 16,000,000 gal. per year during the second half of 1952.

American Society for Testing Materials has announced that the organization's fiftieth-anniversary meeting will be held in New York, June 23-27, 1952. A number of technical symposiums are being scheduled, some bearing on oil and gas. Subcommittee chairmen include L. C. Beard, Jr., assistant director of Socony-Vacuum Laboratories, Brooklyn, serving as head of the nontechnical program committee, and K. G. Mackenzie, assistant to the vice president, The Texas Co., heading the finance committee.

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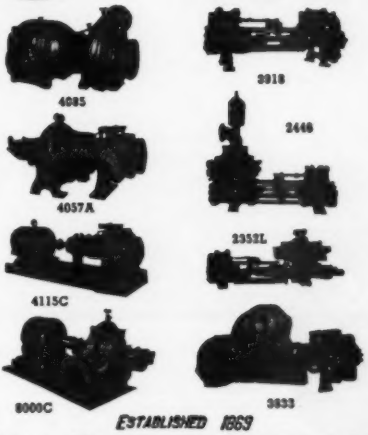

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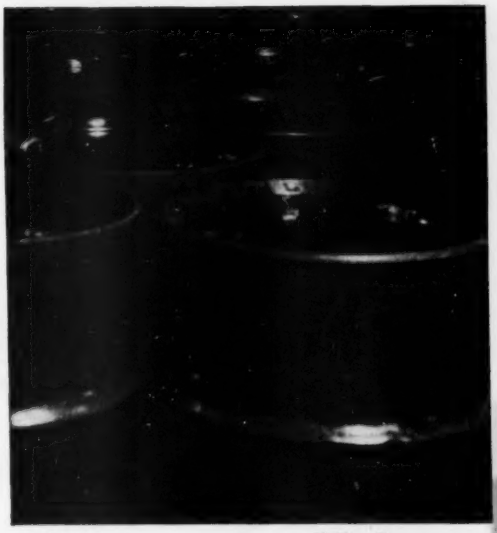

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Exploration and Drilling

Illinois' Reef Belt

THOUGH geologists consider it highly improbable that Illinois' oil potentialities will ever again attract excited national attention, there is a sparsely tested area in the state which recent developments indicate is going to play an ever-increasing role in the production statistics of the Eastern Interior basin.

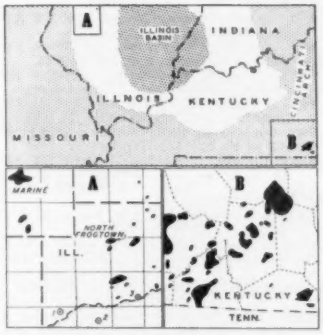
This area lies to the west and north of the deeper Illinois basin proper where development of oil accumulations in Mississippian rocks still dominates Tri-State area activity. Here Silurian-Niagaran reefs, and traps resulting from buildups of those reefs, are the primary objectives in the current exploratory effort.

Data accumulated to date do not indicate that the reef building in this belt was on a scale at all comparable to that existing in Alberta during Devonian time nor in West Texas during Permo-Pennsylvanian time, but rather that the reef buildups, though possibly numerous, are comparatively tiny.

Near the southwestern end of the northeast - southwest trending belt across Illinois now being seismographed for reef-formed structures, is Marine pool (see box A on map), the first Niagaran reef recognized in Illinois away from the outcrop area in the northern part of the state. Marine, discovered in 1943, is an example of what might be expected in this area. The field has about 150 wells and has produced more than 7,000,000 bbl. of oil, principally from Niagaran detrital limestones blanketing a reef near the Silurian - Devonian contact and from several zones within the reef itself. The field reached peak production of nearly 3,200 bbl. daily back in 1946 and is currently producing 2,200 bbl. daily.

Following the discovery of Marine a few other oil-bearing Silurian coral reefs were found or recognized at scattered points in this general area and recent reef strikes southeast of Marine have indicated the value of the long-held ideas of Illinois geologists that a Silurian reef belt lies south of the one exposed around the Michigan basin and links that northern belt to the border of the Ozark region of east-central Missouri.

Of current interest is North Frogtown (see map), a Silurian reef pool



discovered last April. There are now 11 wells in this field. A well that flowed over 500 bbl. of oil on a 10-hour test of the reef at 2,225-2,310 ft., indicating the best well in the field to date, is being completed.

The most recent discovery is Gulf Refining Co. 1 Oelze, 1 on map, which cut over 100 ft. of reef material and flowed oil at substantial rates on drill-stem tests below 2,000 ft. Regional subsurface studies indicate that this wildcat may have opened another North Frogtown.

At 2 on map is Okawville pool, a reef discovery of last May, and at 3 is another reef discovery now being put on pump after flowing 150 bbl. daily for 3 days. To the south a few miles off the map is McKinley pool where Silurian reef production was found in 1948. A few miles east and north of McKinley is Beaucoup where reef production was discovered last August.

While back in this eastern area it is fitting to mention a spot of activity in a little-heard-of portion of Kentucky. In Monroe County (arrowed spot on map) more than 25 rigs are digging for oil in Ordovician-Trenton limestones at 350-450 ft. from which one two-well lease produced 10,000 bbl. of oil in a period of 3 weeks.

This development is located on the southeast flank of a structure known as Meridith Creek dome, the axis of which corresponds to the axis of the Cincinnati arch in this area. The fractured zones in the Trenton limestones along the arch are characterized by high initial yields and rapid decline and this new field is not expected to be an exception. Most of the other oil and gas fields shown on the map produce from Devonian - Corniferous (Onondaga) limestones. Immediately to the east and south of Monroe County are fields which produce from limestones in the Trenton.

Philip C. Ingalls.

HIGHLIGHTS OF WEEK'S DEVELOPMENTS

ROCKY MOUNTAIN AREA.—Amerada Petroleum Corp.'s second well at Beaver Lodge flowed at the rate of 52 bbl. of oil per hour on drill-stem test of the Madison(?) for the third producer in North Dakota. Some 180 miles southwest, Shell Oil Co. tested oil at a second wildcat in northeastern Montana. Sinclair Oil & Gas Co. recovered oil on test of a new northeastern Colorado wildcat.

NORTH TEXAS.—Flowing production on drill-stem test at Engle Petroleum Co. 1 Collier opened deep production in east-central Montague County. Nolan County discovery on ranch of Billie Hanks, San Angelo, gaged 230 bbl. of oil in 14½ hours.

SOUTHWEST TEXAS.—Unconfirmed reports on Mikton Oil Co. 1 W. F. Stelzer, Bandera County wildcat, are keeping interest in this tight hole at a high pitch. It is said that the well has 100 ft. of saturated sand divided between several zones.

OKLAHOMA.—Two wildcats in the Oklahoma Panhandle, both in Beaver County, have logged promising shows.

Kansas

Norton County Wildcat Gets Lansing Showings

THE Texas Co. is preparing to test oil showings found in the lower Pennsylvanian section at its 1 Harmonson, SE SE NE 23-4-23, a rank wildcat in Norton County, in the extreme northern part of the state. Prospective pay zone was logged at 3,673-3,709 ft., where a drill-stem test recovered some free oil with 35 ft. of oil-cut mud. Hole has the Lansing lime at 3,408 ft. (—1,087 ft.) and went out of the Kansas City lime at 3,642 ft. Casing was run through the section to 3,736 ft. in granite wash, topped at 3,723 ft. Total depth is 3,748 ft.

Location of the well, 10 miles south of the town of Norton, in the south central part of the county, is more than 15 miles from nearest production, this being in the West Ray pool, in the extreme southeast corner of the county. All present production in this county is confined to a few small pools on the eastern edge, bordering Phillips County.

The area around the Barrett pool, southwest of the Trapp pool, in Barton County, continued active with Rocket Drilling Co. testing the Lansing-Kansas City zone at its 1 Putnam, NW NW NW 7-17-13, for a possible new discovery a mile south of present production. The well got water in the Arbuckle at a total depth of 3,489 ft. Plug then was set at 3,412 ft. and casing perforated in the Lansing-Kansas City lime at 3,247-97 ft., where the well at latest report was swabbing at the rate of 2 bbl. of oil per hour. Top of the Lansing is 3,224 ft. (—1,240 ft.).

Alpine Oil & Royalty Co. has another prospective new pool discovery in Barton County at its 1 Stueder, SE SE SE 36-17-12, 3 miles southwest of nearest production in the Kraft-Prusa field. A 45-minute drill-stem test at 3,239-64 ft. in the Lansing-Kansas City section topped at 3,063 ft. (—1,236 ft.), got 125 ft. of oil-cut mud with bottom-hole pressure of 710 ft. Showings also were found in Arbuckle lime, topped at 3,371 ft. and drilled to 3,381 ft. Casing has been run to 3,379 ft.

Lario Oil & Gas Co. has a small pumper at its 1 Wilbert, SE SE NW 15-19-15, a Reagan sand discovery south of the Albert pool, also in Barton County. Latest reported gage was 20 bbl. of net oil with 32 bbl. of water in 24 hours. Pay is at 3,272-76 ft. The well is separated from the Albert pool by dry holes.

Anderson-Prichard Oil Corp. has completed its 1 Cochlin, SW SW SW 19-22-11, Stafford County, making 210 bbl. per day on the pump from Arbuckle lime at a total depth of 3,663 ft. Pay is open from 3,659 ft. Location is ¾ mile southeast of the Heyen pool and a mile west of the Richardson pool, and may be a link in connecting the two producing areas.

KANSAS SUCCESSFUL WILDCATS

Ellis County: B & R 1 Stackhouse, SW NW NE 23-12s-18w, 75 bbl. oil from Lansing-Kansas City at 3,434-38 ft., TD 3,621 ft., old Arbuckle producer worked over, new pay in Koblitz.

Lion Oil 2 Herl, NW NE SE 28-14s-17w, pumped 454 bbl. from 3,382-3,402 ft., TD 3,612 ft., new pay in Herl.

Stafford County: Anderson-Prichard 1 Cochlin, SW SW SW 19-22s-11w, pumped 210 bbl. oil from Arbuckle at 3,659-60 ft., TD.

KANSAS WILDCAT FAILURES

Barton County: Honaker 1 Robl, SE SE SE 27-18s-11w, dry, TD 3,370 ft.

Alpine 1 Klein, NE NE NE 36-18s-12w, dry, TD 3,460 ft.

Hartman 1 Ewalt, SE SE SE 35-19s-13w, dry, TD 3,495 ft.

Cowley County: Champlin 1 Bevis, SE SE SW 13-30s-3e, dry, TD 3,340 ft.

Decatur County: Peel-Hardman 1 Vasak, SE SE NE 4-4s-28w, dry, TD 4,120 ft.

Pack 1 Green, NW NW NW 8-5s-27w, dry, TD 4,418 ft.

Ellis County: The Texas Co. 1 Christler, NE NW SW 36-11s-16w, dry, TD 3,432 ft.

Buffalo 1 Dortland, NW NW NW 24-14s-16w, dry, TD 3,480 ft.

Finney County: Champion 1 Miller, C SW 16-22s-34w, dry, TD 4,835 ft.

Harvey County: Husky 1 Balzer, SW SE SW 26-23s-2e, dry, TD 3,331 ft.

Kingman County: Champlin-Beardmore 1 Coleman, CWL NE NE 1-28s-8w, dry, TD 4,478 ft.

McPherson County: Continental Oil Co. 1 Mattson, NE NE NE 8-17s-4w, dry, TD 3,840 ft.

Musgrove 1 Larson, NW NW NW 20-18s-3w, dry, TD 3,682 ft.

Meade County: Columbian Fuel 1 Adams "F," C SE NW 30-34s-29w, dry, TD 6,297 ft.

Ness County: Pabco 1 Ryersee, NE NE NW 2-19s-21w, dry, TD 4,260 ft.

Norton County: Murfin et al 1 Lowery, SW SW SW 10-4s-21w, dry, TD 3,788 ft.

Pawnee County: Wentworth 1 Hinshaw, SE SE SE 27-21s-20w, dry, TD 4,696 ft.

Phillips County: Lewis 1 Pruess, SE NE NW 10-3s-19w, dry, TD 3,410 ft.

Rice County: Hinkle 1 Leonard, NW NW NE 25-20s-7w, dry, TD 3,410 ft.

Rooks County: Laura Jane 1 Stice, SW SW SE 13-7s-20w, dry, TD 3,599 ft.

Laura Jane 1 Holler, NW NW NW SW 20-9s-20w, dry, TD 3,932 ft.

Hartman 1 Ross, NW NW NW 7-10s-17w, dry, TD 3,683 ft.

Stafford County: Petroleum, Inc. 1 Wetig, NW NW NE 31-21s-13w, dry, TD 3,758 ft.

EASTERN NEBRASKA SUCCESSFUL WILDCAT

Richardson County: Fall City Production 2 Schock, SE NW SW 29-1n-16e, 25 bbl. oil from Hunton at 2,340-45 ft., TD 2,349 ft.

EASTERN NEBRASKA WILDCAT FAILURE

Richardson County: Polinsky 1 Cornelius, SW SW SE 16-3n-14e, dry, TD 2,658 ft.

North Central Texas

Montague County Discovery Set to Test Two Pay Zones

WICHITA FALLS.—Engle Petroleum Co. 1 Frank Collier, east-central Montague County wildcat, was holding considerable interest. At week's end the possible two-pay discovery was ready for production tests after setting pipe to 6,841 ft.

The well and its location in the Joseph Collier Survey 6 miles northeast of Montague is of particular interest in that it is in an area that has seen no drilling since Sinclair Oil & Gas Co. drilled an 8,000-ft. dry hole several years ago. Sinclair's well is a couple of miles south of the Engle test.

First shows of pay, said to be Strawn, was in sand at 4,270-81 ft. A 90-minute test had gas in 35 minutes and recovered 550 ft. of oil, plus some oil and water-cut mud. Tops had not been determined, but conglomerate with light oil shows were drilled from 6,388-97 and 6,397-6,400 ft. First drill-stem test at 6,391-6,400 ft., open 3 hours, recovered 180 ft. of heavily oil and gas-cut mud, 90 ft. of mud that was about half oil, and 630 ft. of salt water.

Drill-stem test at 6,455-66 ft., open 90 minutes, flowed oil in 40 minutes at the rate of 60 bbl. an hour. Bottom-hole flowing pressure was 2,350 psi. Before setting pipe, operators had flowing oil, which was not gaged, from 6,466-74 ft.

In Nolan County, Seaboard Oil Co. and Continental Oil Co. 1 Hanks, 28-Z-T&P, two-zone discovery 7 miles northeast of Blackwell, was ready for completion. According to some calculations, the well was in the Canyon when it flowed oil to pits on a drill-stem test at 5,418-36 ft. However, completion was apparently to be made from perforations at 5,540-60 ft., identified as Strawn. The latter section gaged 230 bbl. of oil in 14½ hours through ¼-in. choke. The oil was cut 5 per cent with sediment and drilling water.

NORTH CENTRAL TEXAS (DISTRICTS 9 AND 7-B) SUCCESSFUL WILDCATS

Archer County: Megargel Drilling Co. 1 Bishop, Blk. 19, Meades Subd., 2½ mi. NE Megargel, TD 1,416 ft., pay 1,413 ft., pumped 75 bbl. 40°-gravity oil.

G. J. Scholl 1 C. Cowan, I. W. Gholson Sur., 10 mi. SE Archer City, TD 963 ft., pumped 24 bbl. oil.

Cooke County: Voth Brothers Drilling Co. 1 R. W. Trew, G. W. Long Sur., A-570, 7½ mi. NW Muenster, TD 1,818 ft., pay 1,200 ft., pumped 17 bbl. 39°-gravity oil.

Haskell County: E. K. & E. M. Burt 2 Swenson Bros., 13-1-BBB&C, TD 2,507 ft., Swastika pay 2,499 ft., flowed 84 bbl. 42°-gravity oil, ¼-in. choke, TP 75 psi., GOR 400 cu. ft.

Shackelford County: H. R. H. Drilling Co. 1 Newcomb, 12-3-H&TC, TD 1,619 ft., Cook pay 1,593-1,663 ft., pumped 35 bbl. 38°-gravity oil.

G. E. Kadane & Sons 2 Reames-Thompson, Sec. 25, BAL Sur., TD 3,003 ft., elev. 1,251 ft., Strawn sand 2,990 ft., pumped 42 bbl. 41°-gravity oil.

Stephens County: Sorrell Oil Co. 1 Elva Plumb, 38-7-T&P, TD 4,075 ft., elev. 1,424 ft., Bend 3,668 ft., flowed 24 bbl. 43°-gravity oil, 48/64-in. choke, TP 100 psi., GOR 425 cu. ft.

Taylor County: Sojourner Drilling Co. 1 Z. Oswalt, J. W. Stewart Sur., TD 5,000 ft., Gray sand 4,417 ft., pumped 22 bbl. 40°-gravity oil.

Wilbarger County: Perkins Bros. 1 W. T. Waggoner, 49-2-H&TC, TD 3,882 ft., Ellenburger 3,802 ft., pay 3,872 ft., flowed 97 bbl. 38°-gravity oil, 32/64-in. choke, TP 60 psi., GOR 320 cu. ft.

Frank Wood 1-QQ Waggoner, 18-4-H&TC, TD 2,600 ft., pay 2,362 ft., pumped 29 bbl. 39°-gravity oil.

NORTH CENTRAL TEXAS (DISTRICTS 9 AND 7-B) WILDCAT FAILURES

Archer County: Akin & Dimock 1-B Echols, TE&L Sur. 2,419, dry, TD 5,233 ft., Caddo, 4,642 ft.

Coleman County: DPL Co., Inc. 1 H. M. Parker, Sec. 113, ETRR, dry, TD 3,727 ft., elev. 1,969 ft., Morris 3,182 ft., Fry 3,240 ft.

Louis Franklin 1 Kingsbury, J. A. H. Cleveland Sur. 495, dry, TD 1,577 ft.

Monty Freeman 1 W. W. Rae, Sec. 309, G. W. Morgan Sur., dry, TD 3,248 ft., Morris 3,238 ft.

Forest Gregory 1 Eddie Garrett, J. S. Martin Sur. 217, dry, TD 1,618 ft.

R. W. McKissick 1 Carrie Harlee, HT&B Sur. 1, dry, TD 2,945 ft., elev. 1,842 ft. Jennings 2,742 ft.

Clay County: Russell Maguire 1 E. B. Nutter, J. Morgan Sur., dry, TD 6,110 ft., Ellenburger 6,003 ft.

Cooke County: Van Grisso Oil Co. 1 C. E. Moon, F. Hamilton Sur., dry, TD 2,410 ft.

Eastland County: Bankline Oil Co. 1 A. W. Mueller, 71-4-H&TC, dry, TD 4,010 ft., Ellenburger 3,962 ft.

Fisher County: C. E. Aikman 1 G. E. Kent 62-319-Gilespie CSL, dry, TD 6,309 ft.

Foard County: The Texas Co. 1 H. M. McCelvey, Sec. 3, H&TC, dry, TD 6,203 ft.

Haskell County: Hunter & Hunter 2-E Pardue, 6-5-H&TC, dry, TD 3,719 ft.

Jack County: Twin Oil Co. 1-A H. C. Moore, B. W. Clendennen Sur., dry, TD 5,309 ft.

Jones County: T. C. Billups 1 E. L. Phillips est., Harrison CSL, dry, TD 3,250 ft., Gunsite 3,119 ft.

W. M. Jarrell 1 W. T. Davis, 40-15-T&P, dry, TD 2,717 ft.

Fred Pool, Jr. 1 J. F. Peterson, 19-3-H&TC, dry, TD 3,295 ft.

Knox County: James R. Dougherty est. 1 Davis & Gauss, D. G. Burnett Sur. 19, dry, TD 5,690 ft.

Lampassas County: T. G. Shaw 1 Fred

Felty, Sec. 2, G&BN, dry, TD 2,603 ft., Ellenburger 2,495 ft.

Montague County: Continental Oil Co. 1 R. L. Brown, H. Ravenstone Sur., dry, TD 6,455 ft.

Standard Oil Co. of Texas 1 Lauderback, Tract 2, F. Robertson Sur., dry, TD 2,833 ft., Ellenburger 2,576 ft.

Shackelford County: Phillips Petroleum Co. 1 Roark, 45-12-T&P, dry, TD 5,057 ft., Caddo 4,257 ft., Lake sand 4,590 ft., Bend conglomerate 4,642 ft., Ellenburger 4,877 ft.

Taxman Oil Co. 1 Snyder, 13-A-AB&M, dry, TD 4,295 ft., elev. 1,566 ft., Caddo 3,730 ft., Ellenburger 4,237 ft.

R. Clay Underwood 1 G. R. Davis, 42-13-T&P, dry, TD 1,860 ft., Sedwick 1,109 ft.

Big West Drilling Co. 3-3 Nail, Sec. 43, ETRR, dry, TD 1,034 ft.

Wichita County: Consolidated Oil Co. 4-A Laukhuf, Blk. 5, Cherokee CSL, dry, TD 4,459 ft.

Wilbarger County: W. H. Wilson 1 W. T. Waggoner, 65-14-H&TC, dry, TD 2,152 ft.

Wise County: W. L. Rodgers 1 O. D. Trammell, T. Denson Sur., A-239, dry, TD 5,097 ft.

Mississippi

Two New Wilcox Fields for Franklin and Adams Counties

JACKSON.—Lion Oil Co. 1 Thomas, 3-4n-1e, new Franklin County Wilcox discovery, has been shut in for storage after testing oil into pits. Just before being shut in, the well flowed at the rate of 14½ bbl. of fluid per hour for 4 hours through 12/64-in. choke. Tubing pressure registered 250 psi. Fluid was cut with 12 to 24 per cent brackish water. The name Freeswood has been adopted for this new field.

Northwest of Natchez, Adams County, Humble Oil & Refining Co. B-2 James S. Giles, et al, has been completed as a new Wilcox discovery. Drilled to total depth of 6,509 ft., casing was perforated at 5,287-91 ft., and the well was potentialed for 180 bbl. of 45.6°-gravity oil in 24 hours through ½-in. choke. Tubing and casing pressure were reported at 700 psi. The name Cowpen Point has been adopted for this new field. Meanwhile, Humble has obtained permit to drill B-3 Giles, which is located approximately 660 ft. north of the discovery.

In southwestern Jones County Superior Oil Co. 1 W. H. Cass, et al, 8-7n-13w, encountered a slight show in a Lower Tuscaloosa "stringer" sand at 8,577-92 ft. After running electric log, side-wall samples were taken at that depth with recovery being described as tight sand with odor and dark-brown stain but no fluorescence. A slight show of dead oil was recovered in the Massive sand but is considered to be of no consequence. Operators have plugged back and are drilling side-tracked hole in order to core the section which carried shows.

On the flank of Glazier Salt Dome, Perry County, Union Producing Co. 1 Hinton, 30-4n-9w, confirmation test to the discovery, recovered oil on four drill-stem tests in the Upper Tuscaloosa. Gravity of the oil was 11.4°. Coring started at 7,049 ft. and was continued to present depth of 7,197 ft.

The last drill-stem test was conducted at 7,161-87 ft. with recovery being 360 ft. of heavy black oil after tool was open 15 minutes. To present depth, approximately 32 ft. of permeable sand and 30 to 40 ft. of tight sand has been recovered in this venture.

MISSISSIPPI WILDCAT FAILURES

Adams County: Barnett Serio C-1 George Armstrong, 27-5n-2w, dry, TD 7,010 ft.

George County: Harold H. Duck 1 A. F. Dantzler, 20-2s-8w, dry, TD 8,702 ft.

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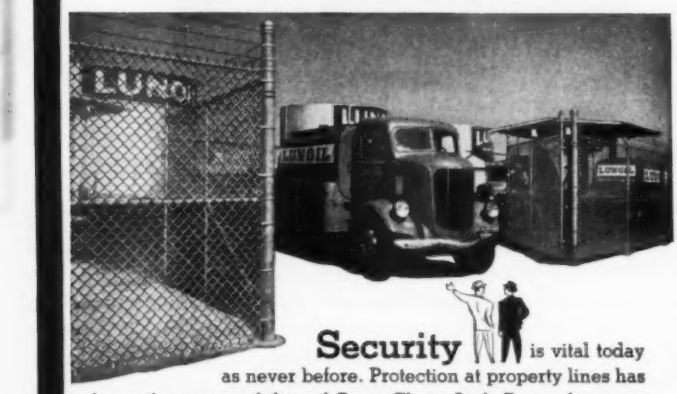
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Jefferson County: Fortenberry Drilling Co. 1 William P. Williams, et al, 52-9n-1w, dry, TD 6,499 ft.
Warren County: Magnolia Petroleum Co. 1 Martin Estate, 8-17n-4e, dry, TD 8,258 ft.

ALABAMA WILDCAT FAILURE

Choctaw County: Lionel Petroleum Corp. 1 A. J. Harrel, 23-11n-5w, dry, TD 4,000 ft.

Rocky Mountain

Amerada, Shell Recover Oil In Williston Basin Wildcats

DENVER.—Another Amerada Petroleum Corp. well in North Dakota flowed oil on test in the Madison this week, making the third well in that state to find oil production. The well is 1 Dilland, C SW NE 31-156n-95w, 1½ miles north of the Amerada North Dakota discovery well in the Beaver Lodge area.

The well flowed 49 bbl. of oil in the first hour of test, 52 bbl. the second, and 57 bbl. per hour in the third and fourth hours of testing. The test was of the zone 8,398-8,444 ft., probably in Madison. Amerada has not announced formation tops below the Spearfish at 5,972 ft.

This is the second well to find oil in the Madison in Amerada's wildcat program along the long Nesson anticline extending through Williams and McKenzie counties. The first well to find oil in that formation was 1 Bakken, C SW NW 12-157n-95w, 9 miles north of the present well. Amerada's discovery at 1 Iverson was completed flowing 200 bbl. of oil daily from the Devonian at around 10,500 ft. The Madison was not tested in this well.

Oil has also been recovered in tests of another Williston basin wildcat. Shell Oil Co. 1 Unit, SW SW NE 30-12n-57e, on the Pine Unit, Wibaux County, Montana, 180 miles southwest of the Amerada Beaver Lodge discovery, recovered 370 ft. of 29.4°-gravity oil and 180 ft. of oily, gassy mud on 55-minute test. The well is now below this zone with additional saturation reported. This well is believed to be in lower Devonian or upper Ordovician. It is 75 miles southeast of Shell's Richey area wildcat, which found oil in the Mississippian 6 weeks ago and is now drilling below 9,832 ft. with Devonian topped at 8,490 ft. There are now five wells in the Williston basin of North Dakota and Montana to find oil in the Mississippian or Devonian formations.

Sinclair Oil & Gas Co. found oil on drill-stem test at 1 Phillips, NE NW SW 19-7n-54w, wildcat in the Northeast Willard area, Logan County, Colorado. This is Sinclair's first discovery in the Denver-Julesburg basin of Colorado, although the company recently made an extension in the Logan pool, 5 miles north of the Northeast Willard wildcat. The test was between 5,114-45 ft. with tool open 1 hour. There was gas at the surface in 9 minutes with a spray of oil. Production is from the D sand topped at 5,114 ft.

Oil was also recovered on test of the Olds Oil Co. 1 Laing, SW SW NE 32-17n-49w, Cheyenne County, Nebraska. The operator is running casing for completion of another apparent discovery. Production was from the J sand between 4,680-95 ft. The zone made 40 ft. of oil with 35 ft. of highly oil-cut mud in 30 minutes.

An interesting well for the central Wyoming area made 6,580,000 cu. ft. of gas daily from a sand in Tertiary this week. The well is Stanolind Oil & Gas Co. 19 M. V. Unit, NW NE SE 11-33n-96w, in Beaver Creek pool, Fremont County. It was planned as a Mesa Verde (Cretaceous) development well. However, a test was made of the zone 899-1,083 ft., and on test there was a flow of 1,350,000 cu. ft. daily with this increasing as the well blew free

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The weight of the MULTIPLEX can be easily adjusted to meet varying operating conditions *without using loose parts or altering the streamlined contour in any way.* Built-in pockets on each side of the MULTIPLEX can be totally or partially filled with lead to increase "falling" weight can be increased as much as 20% over the weight of the Blocks themselves —and added weight can easily be removed later, if desired.

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The MULTIPLEX is the *shortest* Block and Hook Assembly made. It combines Block, spring-loaded Link Ears and Hook all in *one* compact unit that is not only short—*but also unusually narrow.* We invite you to compare dimensions of the MULTIPLEX with those of *any other* Block and Hook of comparable capacity!

The MULTIPLEX is available in a complete range of sizes and capacities to meet any production or drilling requirement. Write today for complete details . . . or see your nearest Baash-Ross representative!

New MULTI-SERVICE HOOK DESIGN!

The spring-loaded MULTIPLEX assembly incorporates *both* a Hook for supporting the swivel, and separate Link Ears equipped with locking arms for supporting the elevator links independent of the Hook. The Hook is equipped with an automatic lock which, when open, helps guide the Hook into the swivel bail. When closed, it cannot open under load —an added safety feature.

OTHER OUTSTANDING MULTIPLEX FEATURES

RUGGED BODY CONSTRUCTION carries the entire load on an internal framework of heavy rolled steel plates through which pass the heat-treated center and coupling pins. Cast steel outer shell is completely free of load stresses, assuring maximum strength for heavy-duty service.

B-R

COMPLETELY STREAMLINED design will not catch in rig or equipment. Even bolts, pins and grease fittings are fully recessed.

B-R

DOUBLE-ROW TAPERED BEARINGS on *each* sheave carry full radial loads, as well as any thrust loads caused by fleet angle or spread of lines. Individual grease ducts to each bearing assure positive and uniform lubrication!

B-R

CLOSE-COUPLED SHEAVE DESIGN (no spacer plates—narrow-width bearings) reduces Block width to a minimum. Sheave spacing is same as Baash-Ross "DCO" Crown Block to eliminate fleet angle and drift.

B-R

ONE PIECE GUARD fits close to sheaves to prevent line from jumping the grooves and also to permit threading Block without removing guard. Or where lines are left looped in rig, guard can be quickly removed for reeving.

B-R

SPRING-LOADED HOOK (full 6" spring travel) eliminates shock when picking up loads, reduces wear on bearings and other parts.

B-R

FULL-SWIVELLING HOOK ASSEMBLY rotates freely through complete 360° circle—or can be quickly locked in any of *eight* equi-spaced positions.

B-R

INDIVIDUAL GREASE DUCTS to each bearing are machined into the heat-treated center pin, with recessed grease fittings conveniently located on outside.

New LOW CENTER OF GRAVITY!

In the MULTIPLEX the weight is concentrated unusually low to assure proper balance both while running and at rest. This means steadier Block travel, faster operations, greater working efficiency.

for ½ hour. There has been no previous Tertiary production from wells drilled in the central Wyoming area.

COLORADO WILDCAT FAILURES

Larimer County, Loveland area: W. E. Atkinson Producing Co. et al 1 B.I.Q. Unit, SE SW NE 31-5n-68w, TD 5,482 ft., PB 4,802 ft., dry, Hygiene gas sand 1,491 ft., Timpas 4,740 ft., Codel 4,809 ft., Muddy 5,274 ft., Dakota 5,467 ft.

Logan County, Sterling area: Deep Rock Oil Co. 1 State "B," NE SE NW 19-8n-50w, TD 4,896 ft., dry, Niobrara 3,540 ft., Ft. Hays 3,829 ft., Codell 3,924 ft., Greenhorn 4,128 ft., D sand 4,376 ft., J sand 4,491 ft., Lakota 4,658 ft., Morrison 4,890 ft.

Wildcat: Count Dunaway—Fitzpatrick 1 Chearns, SW SW SE 31-8n-52w, TD 4,810 ft., dry, Niobrara 3,562 ft., Ft. Hays 3,927 ft., Codell 3,944 ft., Greenhorn 4,122 ft., D sand 4,361 ft., J sand 4,465 ft., Lakota 4,736 ft., Morrison 4,796 ft.

Southwest Yenter area: Plains Exploration Co.-McDermott-Barnhart 1 State, SE SE SE 16-8n-54w, TD 5,765 ft., dry, Niobrara 4,370 ft., Timpas 4,658 ft., D sand 5,161 ft., J sand 5,262 ft., Lakota 5,522 ft., Morrison 5,632 ft.

Morgan County, Northwest Fort Morgan area: H. F. Fuerst 1 Challis, NW NW SE 34-4n-59w, TD 6,140 ft., dry, D sand 5,981 ft., J sand 6,070 ft.

South Fort Morgan area: Lion Oil Co. 1 Rediess-Davidson, SE NE NE 7-1n-56w, TD 5,801 ft., dry, D sand 5,218 ft., J sand 5,281 ft., M sand 5,568 ft., Morrison 5,667 ft.

Washington County, Northeast Akron: Slick-Moorman-R. L. Gangwer & Co. 1 Tveitnes, SE SE NW 28-3n-51w, TD 4,985 ft., dry, D sand 4,360 ft., J sand 4,440 ft., Lakota 4,626 ft., Morrison 4,892 ft.

Blessing area: Lario Oil & Gas Co. 1 V. P. Blessing, SE NW NE 10-1s-54w, TD 5,375 ft., dry, D sand 4,792 ft., J sand 4,848 ft., Fuson 5,039 ft., M sand 5,128 ft., Morrison 5,340 ft.

NEBRASKA WILDCAT FAILURES

Cherry County: Rowley et al. 1 Bachelor, C SE SE 25-30n-33w, dry, TD 4,383 ft.

Kimball County, Kimball area: Nebraska Drillers 1 Everston, SE SW NW 24-14n-56w, TD 6,544 ft., dry, D sand 6,380 ft., J sand 6,502 ft.

Scottsbluff County, wildcat: Hanlon Oil Co. 1 Morrison, SW SW SW 30-20n-55w, TD 5,201 ft., dry, Carlile 4,486 ft., first sand 5,009 ft., Muddy 5,150 ft.

NORTHERN NEW MEXICO WILDCAT FAILURE

San Juan County, Pebble Creek area: Paul Stock et al 1 Gov't.-Mills, C SE SE 10-23n-11w, TD 1,650 ft., completed as water well, Pictured Cliffs 560 ft., Lewis 690 ft.

Appalachian-Ohio

West Virginia Fields Gain Three Shallow Gas Wells

PITTSBURGH.—In Harvey district, Mingo County, West Virginia, United Fuel Gas Co. 41-6782 Henry Closterman gaged 8,245,000 cu. ft. of gas in the Big lime; total depth was 1,685 ft. In Triadelphia district, Logan County, United Producing Co., Inc. 30-1752 Pardee Land Co., Inc. resulted in 2,711,000 cu. ft. of gas from the Berea sand, with total depth at 3,870 ft. In Big Creek district, McDowell County, Hope Natural Gas Co. 9631 Olga Coal Co. tested 1,212,000 cu. ft. of gas, from the Berea; the well was bottomed at 4,611 ft.

In Roaring Creek district, Randolph County, Nollem Oil & Gas Corp. located 1 Goff-Arnold Land Co., elevation 2,751 ft., a wildcat on the Sago Quadrangle, 4 miles south of Lat. 38° 15′, and 2.5 miles west of Long. 80°. In Clover district, Tucker County, Hope Natural Gas Co. has staked a wildcat, 9691 Lee Spessert, elevation 2,633 ft., Belington Quadrangle, 4.55 miles south of Lat. 39° 15′, and 1.55 miles west of Long 79° 45′. In St. George district, Lawrence Parshall 1 Floyd Stahl et al, elevation 1,850 ft., is drilling at 200 ft. In Union district, Preston County, Hope Natural Gas Co. 9638 Margaret C. Kraus, elevation 2,128 ft., ran 7-in. casing at 4,988 ft. In Portland district, 9665 J. Paul Martin, elevation 2,308 ft., is continuing at 3,025 ft., and 9673 Nina Kay, elevation 2,296 ft., is below 1,875 ft. In Beaver Pond district, Mercer County, United Fuel Gas Co. 1-6478 A. W. Hicks, elevation 2,834 ft., is drilling at 7,790 ft.

Northeast Pennsylvania.—A rank wildcat on the John Sheehan farm in Mehoopany Township, Wyoming County, struck a natural gas pocket in a shallow sand and lime zone. There was an estimated 150,000 cu. ft. of gas found at 940 ft. and the operator (a group headed by J. H. Rebold) is continuing drilling in search for commercial production. Located some 43 miles northwest of Scranton, the well had the first natural gas show in this region.

Southwest Pennsylvania.—In South Buffalo Township, Armstrong County, Pittsburgh Plate Glass Co. 2-839 Mary A. McGinley, elevation 1,153 ft., is drilling at 6,554 ft. In Unity Township, Westmoreland County, Peoples Natural Gas Co. 1-4003 A. J. Dotterway, elevation 2,094 ft., shut down at 739 ft. to run casing.

Maryland.—No new work or completions were reported in Garrett County. Eberly & Snee 3 Eli Beechie, elevation 2,462 ft., reported the chert at 3,687 ft., and is drilling at this depth.

OHIO

Waverly Oil Works 1 John Laska, Lot 7, Brunswick Township, Medina County, found Clinton sand at 3,304-11 ft. with a show of

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oil and another sand at 3,340-77 ft. with a show of oil and gas. After shot, the well made 25 bbl. of oil in 24 hours, plus 350,000 cu. ft. of gas.

In Perryton pool, Frank Brendel Oil & Gas 7 Rolla Fairall, Section 7, Jackson Township, Muskegon County, made a good showing of oil natural from Clinton sand at 3,138-67 ft. After shooting with 150 qt., the well made 75 bbl. in 24 hours.

Mid East Oil's 6 Samuel Gutridge, Section 23, Hopewell Township, Licking County, made 75 bbl. in 24 hours after a 120-qt. shot. Clinton sand from 3,051-89 ft. made a good oil showing natural.

In New Castle Township, Coshocton County, Oxford Oil 3 Daisy Staats, Third Quadrangle, came in with a fair show of oil and gas natural. After shooting with 150 qt., the producer made 30 bbl. in 24 hours.

(Continued on page 188)

Oklahoma

Oil Indication Found in Two Panhandle Wildcats

TWO wildcats in the Oklahoma Panhandle, both in Beaver County, have logged promising showings. Pure Oil Co. 1 Albert, SE SE SW 16-5n-26eCM, 3 miles northwest of Knowles, in the northeastern part of the county, recovered gas and oil-cut mud in a series of drill-stem tests in the lower part of the Pennsylvanian. It is being deepened in exploration of possible lower pay zones. The Huber Corp. 1 Heintz, an outpost for the two-state Light Ranch field, cored sand with good staining and porosity, also in the lower Pennsylvanian, and has run casing for testing. Location is in 15-6n-21eCM.

The Pure well recovered 5 ft. of lime with an odor of oil in a core at 6,025-33 ft. A 90-minute drill-stem test from 6,011 ft. recovered 255 ft. of fluid, of which 150 ft. was oil-cut. With hole deepened to 6,142 ft., another test, open 45 minutes, was run from 6,040 ft., getting gas to the surface in 5 minutes and recovering 370 ft. of fluid, of which 90 ft. was gas-cut.

The new Hoxbar pool opened by Shell Oil Co. and Magnolia Petroleum Co. west of Marlow in northern Stephens has an indicated ¾-mile southeast extension at Gulf Oil Corp. 1 Graves, NE NE SW 12-2n-8w, which made good oil recoveries in drill-stem tests in the Hoxbar pay zone. A 60-minute test at 7,594-7,614 ft. got gas to the surface in 6 minutes and flowed at the rate of 100,000 cu. ft. per day. Recovery in the break-down was 750 ft. of 35.2°-gravity oil and 630 ft. of heavily oil-cut mud.

Tom G. Prior 1 Vincent, NE NW NW 23-20n-4e, which opens a new Misener pool in the area 12 miles northeast of Stillwater, Payne County, is reported to have swabbed 50 to 60 bbl. of oil per day in initial tests. Pay zone is open at 3,965-71 ft. Location is 1¼ miles northwest of the one-well Westpoint pool.

Testing is under way at Flynn Oil Co.'s prospective discovery well a mile southeast of the Sams pool in Noble County. The well, 1 Wagner, NE NE SW 23-21n-2w, filled 255 ft. of oil, 120 ft. of muddy oil and 180 ft. of gas-cut mud in a drill-stem test, open 2 hours, of the Avant lime pay zone, logged at 3,545-80 ft.

OKLAHOMA SUCCESSFUL WILDCATS

Hughes County: Rogers 1 Nolan, C SW NE 20-8n-11e, flowed 1,500,000 cu. ft. gas from sand at 1,699-1,713 ft., TD; extension to Greasy Creek.

Logan County: Fordee-Rhoades Oil Co. 1 State, SW SW SE 16-17n-1e, flowed 300 bbl. 37°-gravity oil from second Wilcox at 5,050-60 ft., TD 5,067 ft., OWDD.

Oklahoma County: Gulf Oil Corp. 3 Moyer, NW SW NE 15-14n-2w, pumped 6 bbl. oil from Hunton at 5,780-5,858 ft., TD

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6,282 ft., new pay in Coffee Creek district.

Payne County: Evans 1 Cobble, SW NE NE 14-19n-6e, pumped 40 bbl. 41°-gravity oil from Simpson dolomite and Wilcox at 3,314-38 ft., TD 3,342 ft.

Massad 1 Delay, NE NW NW 26-19n-6e, pumped 26 bbl. 41.5°-gravity oil from Burgess at 3,340-46 ft., TD 3,490 ft.

OKLAHOMA WILDCAT FAILURES

Beckham County: Atlantic et al 1 Parker, NE NW SW 14-8n-21w, dry, TD 5,744 ft.

Cotton County: Bundy & Ketelsen 1 Carroll, NW SW NW 32-3s-11w, dry, TD 1,595 ft.

Jackson County: Stanolind Oil & Gas Co. 1 Scott, SW NW SE 12-1s-23w, dry, TD 5,700 ft.

Mitchell-Gage Drilling 1 Dobbs, NE NW NE 35-4n-20w, dry, TD 1,082 ft.

Lincoln County: Creslenn Oil Co. 1 Scott, SW NW NW 27-14n-6e, dry, TD 3,672 ft.

Logan County: Sun Oil Co. 1 Abrams, NE NW SE 9-17n-2w, dry, TD 5,780 ft.

Noble County: Berry Co. 1 Moore, SW SW SE 12-21n-2e, dry, TD 2,905 ft.

Sinclair 1 Case, SE SW NE 7-24n-1e, dry, TD 4,605 ft.

Mazda 1 Ratliff, NW NW NE 34-24n-1e, dry, TD 4,420 ft.

Berry Co. 1 Pribil, NE NE SE 17-21n-2w, dry, TD 4,072 ft.

Okfuskee County: McCaughey 1 Wade, NE SE SW 19-10n-11e, dry, TD 3,230 ft.

Pawnee County: John Lindas Oil Co. 1 Knox, NE SE SE 2-20n-5e, dry, TD 3,332 ft.

Roger Mills County: Gulf and Continental 1 Taylor, C SE NE 14-12n-23w, dry, TD 13,010 ft.

Southwest Texas

Mustang Island-Redfish Bay Link Well Finaled for Gas

CORPUS CHRISTI.—The link well between Mustang Island and Red Fish Bay production has been completed as a gas-condensate producer. Atlantic Refining Co. 1 State Tract 411 flowed at the rate of 3,602,000 cu. ft. of gas daily through ¼-in. choke from perforations at 7,174-80 and 7,130-40 ft. There was also a trace of condensate on the test. This well is located ¾ mile southeast of Atlantic 1 State Tract 413, and 1½ miles north of Mustang Island gas-condensate production.

Mikton Oil Co. 1 W. F. Stelzer, Bandera County wildcat which has created more interest than any other wildcat in Southwest Texas in recent years, is still "tight." However, unconfirmed reports continue to leak out, the latest being that a 5-ft. sand section was encountered, reportedly saturated, and that Mikton conducted a drill-stem test around 3,400 ft.

Cored almost continuously from 2,000 ft., it is said that the well has an aggregate 100 ft. of saturated sand in a possible half-dozen zones.

Robert Ross has set pipe to conduct production tests on two or three shows encountered in 1 Hinton Dickson, wildcat in Bexar County 10 miles northeast of San Antonio. Hole is bottomed at 1,504 ft., top of the Edwards lime. Operator will test intervals 1,075-1,100 ft. and 1,230-60 ft. If tests do prove commercial production, the well will be drilled deeper to test the Edwards lime, its original projected depth.

Eight miles southeast of Bigfoot in Frio County, Shell Oil Co. is cleaning out caving in for completion try at 1 Dennis Thompson, wildcat 1½ miles east of Big Foot field production. Hole will be cleaned out to total depth at 3,489 ft. and liner run.

SOUTHWEST TEXAS (DISTRICTS 1 AND 4) SUCCESSFUL WILDCATS

Frio County: Oil discovery: Sid Katz 2 Simmons, BS&F Sur. 19, A-143, TD 887 ft.,

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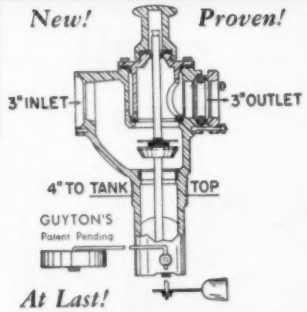

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open hole 880-87½ ft., IP: 6 bbl. oil per day, on pump, 16° gravity.

Jim Wells County: Gas discovery—Piasano Trading Co., Ltd., & G. Ray Boyd 1 Bruno Goldapp, Waldron Subd. of S. Sherman Sur. 25, A-427, TD 6,395 ft., perf. 3,388-3,400 ft., IP: 37,500,000 cu. ft. of gas per day, open flow, SIP 1,446 psi.

SOUTHWEST TEXAS (DISTRICTS 1 AND 4) WILDCAT FAILURES

Bastrop County: G. H. Tracy, et al, 1 W. E. Sanders, Antonio Navarro Seven-League Grant, dry, TD 2,048 ft.

Duval County: William H. Martin 1 Farmers Life Insurance Co., Yates Ranch, AB&M Sur. 416, A-1099, dry, TD 3,220 ft.

Jim Hogg County: Gorman & DeLange, et al, 1 Francisco Trevino Estate, H&GN Sur. 17, dry, TD 3,087 ft.

Kerr County: Dan Auld, et al, 1 William Auld, GC&SF RR Co. Sur. 1815, dry, TD 5,932 ft.

Medina County: Geo. Parker & Chas. L. McCune 1 Ganahl Walker, John Degant Sur. 31, Sec. 35-A, dry, TD 2,270 ft.

Nueces County: Arkansas Fuel Co. 1 Alfred A. Theis, et al, John M. Swisher Sur., A-908, dry, TD 9,018 ft.

San Patricio County: Arnold O. Morgan 1 J. M. Elliott, Block 23, Welder and Odem Sur., dry, TD 5,489 ft.

Starr County: Hickok & Reynolds, Inc., & Geo. H. Coates 3 Ramon, S. de Mendoza, Sec. 300, 18 mi. N of Roma, dry, TD 1,808 ft.

South Louisiana

Texaco Wildcat Completed As 97-Bbl. Oil Discovery

NEW ORLEANS.—A new oil discovery has been completed in Plaquemines Parish at The Texas Co. A-1 State Lease 1607-Blind Bay, Township 22s-21e. Through perforations at 8,363-71 ft., the well is credited with 97 bbl. of 36°-gravity oil daily through 5/64-in. tubing choke. Hole is bottomed at 10,142 ft. with 7-in. production casing cemented at that depth.

Meanwhile, Texaco is drilling below 3,000 ft. in shale at 2 State Lease 160 Blind Bay, located 4,500 ft. east of 1 State-Blind Bay, at which drilling stopped last week at total depth of 16,003 ft.

In Lafourche Parish, Humble Oil & Refining Co. has plugged its confirmation effort in the East Golden Meadow field. The firm's C-2 Louisiana Land & Exploration Co. was drilled to 13,560 ft. before being plugged. Location is in Township 19s-22e. The discovery well, Humble C-1 Louisiana Land & Exploration Co., was completed in September of this year for 269 bbl. of 57°-gravity distillate from perforations at 6,166-69 ft. Electrical survey indicated 5 other sands in this well.

North of Thibodaux in the same parish, Callery & Hurt, Inc., is coring below 13,670 ft. at 1 Caldwell Sugars, wildcat in 19-14s-16e. Elevation of the venture is 11.59 ft., ground.

Texaco has applied for permit to drill a rank wildcat test approximately 16 miles west and slightly north of production in Lake Maurepas field, Livingston Parish. Test will be 1 Gaylord Container Corp., 660 ft. from south line and 665 ft. from east line 4-8s-4e in the North French Settlement area of the parish. Production will be sought to 10,500 ft.

North of production in Coquille Bay field, Plaquemines Parish, The California Co., discoverer of the field, has staked location for 1 Grand Prairie Levee District 4-State Lease 1785 Unit 1, 18-19s-18e. The venture has a 12,000-ft. contract depth.

In Iberia Parish, on the northwest edge of New Iberia Townsite, F. Julian Fohs Driller Group 1 Darby Estate, 10-12s-6e, wildcat, was dry at total depth of 11,982

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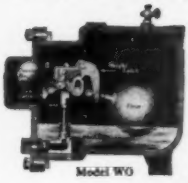
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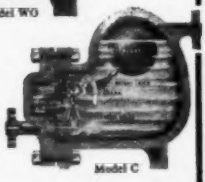
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ft. Slight shows were encountered in the wildcat but none of commercial value.

SOUTH LOUISIANA SUCCESSFUL WILDCAT

Calcasieu Parish: New pay at Iowa—Louis J. Roussel 2 R. Haggert, et al, 11-9s-7w, TD 11,140 ft., perf. 11,023-34 ft., IP: 332 bbl. condensate per day, 50° gravity, 12/64-in. choke.

SOUTH LOUISIANA WILDCAT FAILURES

Avoyelles Parish: Hunt Oil Co., et al, 3 Geo. G. Snowden, Jr., et al, 1-3n-5e, dry, TD 8,360 ft.

Lafourche Parish: The Texas Co. 1 State Leeville East-1970-Twp. 21s-23e, dry, TD 13,008 ft.

Plaquemines Parish: The Texas Co. 1 State-Blind Bay, Twp. 22s-21e, dry, TD 16,003 ft.

Richardson & Bass 1-H Humble-Delacroix, 7-15s-14e, dry, TD 12,730 ft.

California

Texaco Maps Big Drilling Program in Imperial Valley

LOS ANGELES.—By the end of October it is expected The Texas Co. will have started the first of several wildcats it has planned in the Imperial Valley of extreme southern California. The drilling phase climaxes several years' work in that area, during which the company carried out extensive seismic work and in more recent months put together several large blocks of acreage.

The first well will be drilled in Section 18-17s-14e about 5 miles west of Calexico and 1 mile north of the Mexican border. It will be called 1 Jacobs NCT-1. The contract rig to be used on the well will be capable of drilling to depths below 7,500 ft.

The company is in the process of unitizing several other blocks of government leases acquired by individuals. These unit plans had to be negotiated with the government in order for Texaco to acquire all the acreage it desired. As unitizing is completed on these blocks, which extend from the Mexican border north into Riverside County, Texaco will announce the locations of several other wildcats. Since the company announced its first test, at least two other major companies have become interested in acquiring valley leases.

Los Angeles County received five new wildcats, three in the Newhall area and two in the basin area. At recently discovered Castaic Hills, Richfield Oil Corp. will drill 83-35 Golden as a ¼-mile southeast extension attempt in Section 35-5n-17w. Continental Oil Co. already is drilling 2 Rynne-Fisher as a northwest offset and The Texas Co. has staked 1 Honor Rancho-2 in Section 36 as a ¾-mile southeast-extension try.

Union Oil Co. staked location for 1 Ferguson in Section 31-4n-16w, as a ¾-mile-east stepout to Newhall-Potrero production, and plans to drill another wildcat in the Tunnel area some 7 miles to the southeast. The latter will be its 1 Needham in 13-3n-16w. Another wildcat shortly to get under way in the Newhall area is Standard Oil Co. of California 6 Newhall Land in Section 19-4n-16w, about ½ mile northeast of Castaic Junction field.

The two wildcats in the southern part of the county are Texaco 1 McNally Ranch in Section 23-3s-11w and Bolsa Chica Oil Corp. 1 Kidson in Section 22-2s-15w. The latter is about ¾ mile east of the Playa Del Rey field.

In the San Joaquin Valley region, Union is getting under way with its 1 Mee in the Peach Tree area west of Coalinga, Fresno County. Located in Section 11-20s-10e, the wildcat is about 10 miles northeast of San Lucas.

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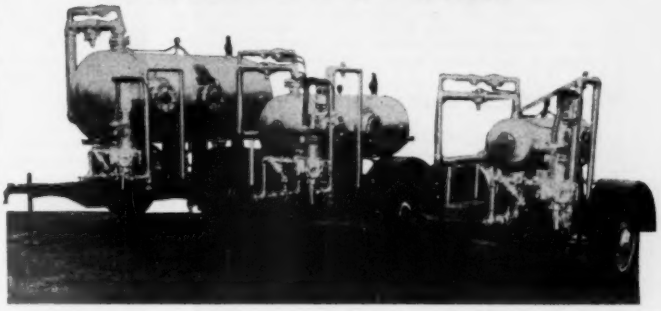

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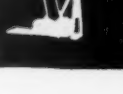

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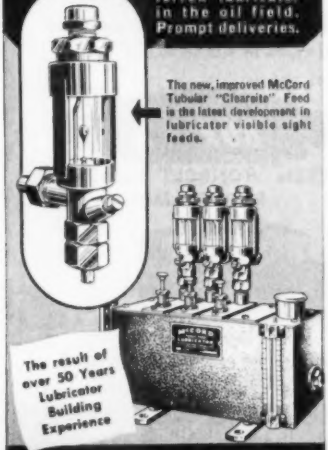

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Kern County, Texaco has staked location for a deep test in Section 20-29s-25e. The wildcat will be 1 K.C.L.-Goosloo. It will be located about ½ mile southwest of Western Gulf Oil Co.'s recently staked 57-17 McAlpine Community.

CALIFORNIA SUCCESSFUL WILDCAT

Kern County, new fault-block discovery ¼ mile southwest of West Edison production: California Exploration Co. & Macmillan Petroleum Co. 28-6 Clerico, SW SE 28-30s-29e, IP flowed 195 bbl. daily, perf. 4,046-4,740 ft., 22° gravity, 0.2 per cent cut. 11/64-in. bean, Chanac oil sand 4,006 ft., Santa Margarita oil sand 4,415 ft., Porter 4,548 ft., TD 5,175 ft., elev. 479 ft.

CALIFORNIA UNSUCCESSFUL WILDCATS

Fresno County, Jacalitos Hills area: Standard Oil Co. 38 Caribou, 32-21s-16e, dry, TD 6,848 ft., elev. 1,009 ft.

Kern County, Santos Creek area: Independent Exploration Co. 2 Theta, 29-28s-20e, dry, Buttonbed 2,080 ft., TD 2,336 ft., elev. unreported.

Kings County, Pyramid Hills area: Norris Oil Co. 1 Hand, 29-24s-18e, dry, Kreyenhagen 760 ft., thrust fault 2,180 ft., McClure shale 2,535 ft., TD 3,008 ft., elev. 652 ft.

Los Angeles County, Castaic area: G. Allen 1 Allen, 19-5n-16w, dry, TD 3,700 ft., elev. 1,230 ft.

Whittier area: Los Nietos Co. 2 Los Nietos Whittier Crude, 22-2s-11w, dry, TD 5,431 ft.

San Luis Obispo County, Cuyama Valley area: Sloan Oil Co. 54-23 Cebrian Estate, 23-11n-28w, dry, bottomed in Cretaceous, TD 3,597 ft., elev. 2,030 ft.

Permian Basin

New Permsylvanian Strike Likely for Dawson County

MIDLAND.—Greenbrier Oil Co. 1 Lindsey, western Dawson County wildcat, had prospects of giving the county another Pennsylvanian strike. Location in 132-M-EL&RR is just 6 miles south of El Tee Oil Co. 96 Briley, a reef discovery carried in this week's completions.

In the Greenbrier well, a drill-stem test from 10,954-72 ft. had gas in 5 minutes, oil in 13 minutes and flowed at the rate of 30 bbl. an hour. A test on perforations at 10,957-67 ft. had mud and oil in 7 hours then gaged 38 bbl. of oil in 12 hours through ⅝-in. bottom choke and 1-in. top opening. It then started making slugs of mud, and operator had to bail it out.

Speculation is that Greenbrier's well is in the Strawn of the Pennsylvanian. Top of the limestone was around 10,940 ft., minus 7,889 ft., compared to the El Tee discovery which had the productive reef at 8,570 ft., minus 5,479 ft.

Third Spraberry well for the new Snowden-Spraberry field of east-central Dawson has been completed by James H. Snowden. The 1-40 Dean finished as a pumper, making 79 bbl. of oil a day after shooting open hole with nitro.

Northeast of Lamesa, Gulf Oil Corp. 1-A Dean, formerly Snowden 1-29 Dean, was coring below 10,228 ft. with no further oil shows reported below the section drill-stem tested from 10,029-73 ft., which developed 90 ft. of clean oil and 100 ft. of mud.

Gulf 1-Y Dean in 35-2-6N-T&P recovered 44 ft. of dolomite with slight oil shows in a core between 10,728-72 ft.

George W. Strake 1-B Winterbotham made a small flow of oil from Canyon sand after finding the Ellenburger dry in drilling to 8,013 ft. At last report, perforations at 6,588-6,605 ft. yielded around 2 bbl. of oil an hour by swabbing.

Moore Exploration Co. 1 Noelke, 10 miles southwest of Mertzon, completed as an Ellenburger discovery. Potential test from open hole at 7,806-38 ft. was 250 bbl. of 44°-gravity oil a day through 20/64-in. choke. Top of the formation was 7,804 ft., minus 5,305 ft.

In Midland County, Greenbrier and others 1 McAlister Devonian test southeast of Germania recovered 40 ft. of drilling mud with no shows at 10,241-10,302 ft. The section had not been identified but was thought to be the first Pennsylvanian limestone to be penetrated. It was drilling ahead.

Republic Natural Gas Co. 1 Bryant Estate was completed as an extension and connecting well between the Midkiff and Driver fields. Daily potential was calculated at 497 bbl. of oil, based on an actual 8-hour flow through 1-in. choke. Pay was in open hole at 7,144-7,229 ft. Flowing pressure was 30 psi.

Northwest of Midland, Blackwood & Nichols 1 Moss was drilling lime and shale at 10,581 ft. Top of the Pennsylvanian was placed at 10,460 ft., minus 7,631 ft.

The same firm's 1 Hofferkamp, northeast of Midland, was drilling below 11,263 ft. and looking for top of the Barnett shale. Earlier the wildcat recovered gas-cut mud at 11,056-11,146 ft., also at 11,149-74 ft., and 5 ft. of free oil plus 50 ft. of slightly oil and gas-cut mud from 11,157-11,214 ft.

In Upton County, Greenbrier 1 Windham, 14,000-ft. wildcat south of the Wilshire Pennsylvanian and Ellenburger field, recovered its first free oil on drill-stem test identified as Pennsylvanian lime at 10,112-39 ft. The testing tool was open 2 hours. Gas reached the top in 10 minutes and recovery was 560 ft. of clean oil, 30 ft. of oil-cut mud, and no water. Flowing pressure was 300 psi.

A 2-hour test from 10,280-10,360 ft. had gas in 1 hour and 20 minutes and recovered 90 ft. of oil-cut mud and the same amount of mud-cut oil. It was drilling ahead.

Spraberry discoveries continue east along the south border of Glasscock County. This week Placid Oil Co. 1 William Howard, 30-35-5S-T&P, had total depth at 6,595 ft. and was ready for completion test. Top of the pay had not been reported, but after Hydrafrac treatment the well swabbed 235 bbl. of oil plus some acid residue. Following that it flowed 68 bbl. of oil in 11 hours through ¾-in. choke. Flowing pressure on tubing ranged from 50-100 psi.

WEST TEXAS (DISTRICTS 8 AND 7-C) SUCCESSFUL WILDCATS

Crockett County: Continental Oil Co. 1-E Powell, 62-BB-EL&RR, TD 8,288 ft., elev. 2,757 ft., Strawn 8,086 ft., perf. 8,088-8,112 ft., flowed 264 bbl. 40°-gravity oil, 45/64-in. choke, GOR 939 cu. ft.

Dawson County: El Tee Oil Co. 96 Briley, 96-M-EL&RR, TD 8,640 ft., elev. 3,091 ft., reef 8,570 ft., perf. 8,575-90 ft., flowed 734 bbl. 40°-gravity oil, 50/64-in. choke, GOR 705 cu. ft., TP 75-135 psi.

Gaines County: Union Oil Co. of California 2 T. C. Weltmer, 16-A12-PSL, TD 7,144 ft., elev. 3,584 ft., pay 7,128-31 ft., pumped 99 bbl. 47°-gravity oil.

Midland County: Sinclair Oil & Gas Co. 3 June Tippett, 17-40-4S-T&P, TD 13,133 ft., elev. 2,870 ft., Ellenburger 12,930 ft., perf. 12,960-13,090 ft., flowed 786 bbl. 51.5°-gravity oil, ½-in. choke, TP 325 psi., GOR 1,160 cu. ft.

WEST TEXAS (DISTRICTS 8 AND 7-C) WILDCAT FAILURES

Bailey County: Phillips Petroleum Co. 1-A Stephens, 24-B-MB&B, dry, TD 8,244 ft., elev. 4,025 ft., Clear Fork 5,057 ft., Abo 6,361 ft., pre-Cambrian 8,190 ft.

Concho County: Seaboard Oil Co. 1 E. H. Sims, P. H. Brooks Sur. 2, dry, TD 4,270 ft.

Crockett County: Terrell Petroleum Co. 1 Texas University Lands, 15-42-University, dry, TD 1,748 ft.

Val Carroll Oil Co. 1 University, 21-42-University, dry, TD 1,639 ft.

Hale County: Southern Minerals and Seaboard 1 Marsh & Earhart, 68-A4-EL&RR, dry, TD 8,508 ft., elev. 3,376 ft., Tubb 5,390 ft., Pennsylvanian 8,355 ft.

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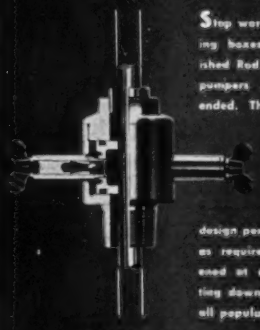

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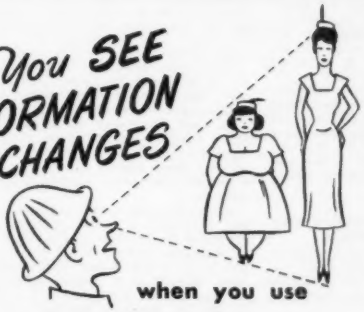

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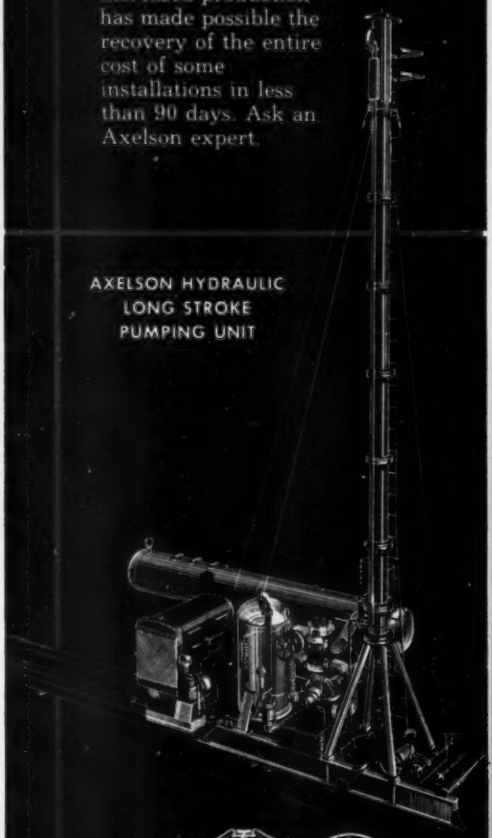

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Howard County: Spartan Drilling Co. 1 Phillips, 19-33-2N-T&P, dry, TD 5,694 ft.

Martin County: Blackwood & Nichols 1 Stimson & Burley, 36-39-1N-T&P, dry, TD 10,897 ft., elev. 2,846 ft., Pennsylvanian 10,507 ft.

Reagan County: Blackwood & Nichols 1 Alexander, 6-M-TCRR, dry, TD 7,358 ft., elev. 2,603 ft., Spraberry 6,416 ft.

Prigge, Bailey & Shatto 1 John Carr, Sec. 11, HE&WT, dry, TD 3,324 ft.

Runnels County: Murray & King 1 Cathey, Sec. 93, H&TC, dry, TD 3,900 ft.

Schleicher County: Los Neitos Co. 1-B Mary McBurnett, 6-A2-GH&SA, dry, TD 5,705 ft., elev. 2,332 ft., Strawn 5,404 ft.

Scurry County: Bankline Oil Co. 1 Joe Parks, 219-97-H&TC, dry, TD 7,676 ft., elev. 2,398 ft., Canyon 7,250 ft., Strawn 7,470 ft.

Robinson Drilling Co. 1 W. A. McGlaun, 177-97-H&TC, dry, TD 3,298 ft.

Upton County: John L. Greer Drilling Co. 1-A Shirk Estate, 25-2-MK&T, dry, TD 2,679 ft., elev. 2,864 ft., San Andres 2,681 ft.

TEXAS PANHANDLE

AMARILLO.—An open flow of 50,000,000 cu. ft. of gas is estimated at Sinclair Oil & Gas Co. 7 Lips, 1½-mile stepout to Lips field in Roberts County. Perforated with 198 shots from 8,574-8,614 ft. in the Atoka, the well tested 10,450,000 cu. ft. of gas through 2-in. tubing, with a 10-minute shut-in tubing pressure of 2,100 psi. It had previously been drilled to 9,223 ft., and plugged back to test a show in the Morrow. However, perforations in that formation from 8,846-86 ft. yielded only 139,000 cu. ft. of gas, and the well was plugged back to 8,672 ft. Sinclair is preparing to acidize.

Three miles to the north, The Texas Co. 1 Flowers is drilling at 8,740 ft. in limestone, with no shows since a core from 7,287-7,306 ft. recovered 19 ft. of gray sand containing stain, odor, and fluorescence throughout. A 1-hour and 20-minute drill-stem test from 7,285-7,306 ft. recovered 20 ft. of drilling mud, with no shows nor pressures recorded.

Randall County had another disappointing wildcat in Placid 1 Greely Trust, bottomed at 8,244 ft. in granite. Several drill-stem tests recovered only salt water, and no shows were reported. Top of the granite is 8,180 ft.

TEXAS PANHANDLE (DISTRICT 10) WILDCAT FAILURE

Briscoe County: H. L. Hunt 1 Ritchie, 68-A1900-R. F. Stevenson Sur., dry, TD 7,900 ft., elev. 2,492 ft., Wichita Albany 2,900 ft., Pennsylvanian shale 5,050 ft., Canyon reef 5,358 ft., Bend 6,690 ft., St. Louis 6,893 ft.

SOUTHEASTERN NEW MEXICO

HOBBS.—Magnolia Petroleum Co. 1 Black, Lea County wildcat in 9-15s-36e, developed further shows of oil on a drill-stem test at 10,929-44 ft. The 3-hour test at that depth was in the lower Pennsylvanian. Recovery in the pipe was 2,070 ft. of oil and gas-cut water blanket, 100 ft. of free oil and 360 ft. of oil and gas-cut drilling mud. Bottom-hole flowing pressure was 1,045 psi. It cored to 10,957 ft. with no shows and was drilling ahead.

The Texas Co. has staked location for a 10,000-ft. Permo-Pennsylvanian test in 33-11s-32e as the 1-BC State. Location is 3 miles northwest of Amerada 1-ECA State, recent Devonian discovery.

In Roosevelt County, Tide Water Associated Oil Co. 1 Grady Best, cut 12½ ft. of pre-Cambrian granite on a core at 7,265-77½ ft. and was shut down for orders.

Paul L. Davis 1 State-Ralph Nix, southeast Roosevelt County wildcat, was drilling below 4,050 ft., which was thought to be in the San Andres.

SOUTHEAST NEW MEXICO WILDCAT FAILURE

Eddy County: John M. Kelly 1 McMillan, 36-20s-28e, dry, TD 7,834 ft., elev. 3,248 ft., San Andres 1,690 ft., Delaware 3,248 ft., Abo 6,335 ft., Wolfcamp 7,240 ft.

Texas Gulf Coast

Live Oak County Wildcat Gets Oil Show in Mackhank

HOUSTON.—Sunray Oil Corp. 1 W. A. Smith, Live Oak County wildcat which recently tested gas condensate in the Slick, Carrizo, and Luling, reports a show of oil on drill-stem test in the Mackhank sand at 7,031½-40 ft.

Using ¼-in. chokes and 630 ft. of water cushion, the well showed a working pressure of 16 psi. and recovery was 270 ft. of oil. Bottom-hole flowing pressure was 575 psi., and shut-in pressure 2,950 psi. Previously, the well tested condensate in the Slick-Carrizo at 6,647-59 ft. and the Luling at 6,793-6,803 ft. Operators are coring ahead at 7,045 ft. This wildcat is in T. B. Reese Survey, approximately 1½ miles north of northeast Goebel production.

First commercial oil production has been opened in Freisburg field, Colorado County, at Sinclair Oil & Gas Co. 1 Cullen, which flowed 386 bbl. of 43.2°-gravity oil daily from a new sand, tentatively named the Cullen sand. Production is through perforations at 9,672-80 ft.

The well was drilled to total depth 10,425 ft. and plugged back to 9,700 ft. after setting 5½-in. casing at 10,250 ft. The new discovery had a casing pressure of 1,800 psi. and tubing pressure of 1,000 psi. Production in Freisburg is from the Wilcox, and all wells produce gas distillate. Nearest production to the new oiler is 2,300 ft. to the northwest of the discovery.

Testing operations are under way at Anderson-Prichard Oil Corp. 1 Miles Knolle, Austin County wildcat 7½ miles northwest of Bellville. At last report, perforations were effected at 9,698-9,700 ft., and crews were conducting drill-stem test.

Newton County has a new oil discovery at Christensen & Matthews 1 V. J. Morgan, et al, which was completed for a potential gage of 50 bbl. of 40.2°-gravity oil daily. Top of the pay was reported at 7,478 ft., and operators perforated 7,548-52 ft. for completion. Gage was made using 9/64-in. choke. This well is located in J. Champin Survey, Abstract 78, Section 11.

C. G. Glasscock 1 F. A. Street, Calhoun County wildcat located ¾ mile southwest of Colomo Creek field, will perforate for production tests opposite condensate show at 5,773-80 ft. Drill-stem test of this interval showed working pressure of 450 psi. at the surface, and recovery was 6 stands of pure condensate.

TEXAS GULF COAST (DISTRICTS 2 AND 3) SUCCESSFUL WILDCATS

Brazoria County: Gas discovery—Champlin Refining Co. A-1 State Lease, Tract 13, Bastrop Bay, TD 7,256 ft., IP: 60,000,000 cu. ft. of gas daily, open flow, SIP 2,296 psi.

Fort Bend County: Gas discovery—Harold Link 1 Cantrell, et al, Sam Stone Sur., A-660, TD 4,750 ft., perf. 4,624-36 ft., no gage.

Matagorda County: Gas-condensate discovery—Magnolia Petroleum Co. 1 Ethel Cornelius, J. C. Peyton Sur., A-74, TD 11,485 ft., perf. 11,375-85 ft., IP: 192 bbl. condensate per day, TP 5,900 psi.

Newton County: Oil discovery—Christensen & Mathews 1 V. J. Morgan, et al, J. Champin Sur., A-78, Sec. 11, TD 8,016 ft., perf. 7,548-52 ft., IP: 50 bbl. oil per day, 9/64-in. choke, 40.2° gravity.

TEXAS GULF COAST (DISTRICTS 2 AND 3) WILDCAT FAILURES

Brazoria County: Ohio Oil Co. 1 Claud B. Hamill Trust, et al, C. Q. Hale Sur., A-576, dry, TD 7,612 ft.

Calhoun County: Los Nietos Co. 1 Willett Wilson, V. Garcia Sur., 8 mi. NE of Port Lavaca, dry, TD 9,510 ft.

Chambers County: General Crude Oil Co. 1 William Rooney, James Hogall Sur., A-14, dry, TD 10,001 ft.

DeWitt County: George W. Graham 1 Mrs. Frances R. Walker, Dolores Aldrette Sur., A-52, dry, TD 7,666 ft.

Floyd L. Karsten 1 Margaret Cottingham, et al, John Tumlinson Sur., A-467, dry, TD 8,510 ft.

Fort Bend County: Gravis & Mitchell, et al, 1 John M. Moore, Sarah Kenedy League, A-45, dry, TD 8,510 ft.

Goliad County: Stanolind Oil & Gas Co. 1 Mary Albrecht, James Clifford Sur., A-88, dry, TD 9,602 ft.

Texita Oil Co. 1 F. Moritz, Mary Curtiss Sur., 9 mi. N of Goliad, dry, TD 4,000 ft.

Hardin County: Shell Oil Co. 1 Kirby Lumber Co. Tr. 105-A, H&TC RR. Sec. 209, A-330, dry, TD 7,359 ft.

Harris County: K. Hughes 1 J. H. Goar Estate, Sarah McKissack Sur., dry, TD 7,515 ft.

Jasper County: Sun Oil Co. 2 Miller Vidor, J. W. Sanders Sur., A-835, dry, TD 11,020 ft.

Liberty County: American Republics Corp. 1 J. E. Broussard, et al, S. D. Joscelyn Sur., A-691, dry, TD 8,967 ft.

Newton County: Texas Gulf Producing Co.-Rowan Fullerton 1 Davis & Carruth, R. J. Bratton Sur., A-839, dry, TD 8,095 ft.

Orange County: John S. Neilson 1 B. E. Quinn, Pinkney Lout Sur., A-17, dry, TD 8,005 ft.

Eastern Texas

Harrison County Wet-Gas Discovery Set to Run Gage

DALLAS.—Zephyr Oil Co. 1 E. S. Bogue, wet-gas discovery in the L. Wallace Survey, 7 miles west of Waskom in Harrison County, had separator and tanks in but had not run potential gage.

The well was shut in after flowing some 2,500,000 cu. ft. of gas a day, plus distillate, through 7/64-in. choke. Pay was identified as the transition zone between the Pettit limestone and the Travis Peak. Pay was from perforations from 6,140-65 ft.

Five miles southeast of Ore City, Grelling & Ellison 1 McGauhy was drilling below 7,694 ft. in lime and shale.

Development work in a new wet-gas area just northwest of Teague in Freestone County was reported as a location. Pure Oil Co. 1 J. A. Wright was spotted slightly more than 1 mile southwest of its 1 Howard, discovery well, and in the Isaac Holman.

Meanwhile the 1 Howard continued testing. Perforations in the Rodessa had been squeezed to try the Travis Peak. Rodessa perforations at 6,805-70 ft. developed 4,000,000 cu. ft. of gas a day, and Pettit perforations at 7,313-84 ft. flowed 5,000,000 cu. ft. of gas a day through ½-in. choke plus 10 gal. of distillate an hour.

Development work was in progress in Rusk County off the south end of the East Texas field and about 2 miles northwest of the Pleasant Mound Woodbine field. Clark and Stone 1 Kangerga Brothers, indicated discovery in the W. R. Moore Survey, set off the field play when it made flows of oil from pay around 3,817-25 ft., according to reports.

Rexal Drilling Co., Kilgore, which has taken over the operation of the 1 Kangerga, has made location for the 2 Kangerga as a west offset in the same survey. E. D. Markham 1 Kangerga is a southwest offset in the Larkin Caison Survey. A rig was also reported moving in for J. L. Crawford 1 J. M. Tipps, in the Thomas Uzzell Survey. A rework job was reported for Jef Bolton 1 J. M. Tipps, Uzzell Survey, which had been drilled to 3,940 ft.

Standard Oil Co. of Texas has made location for another test in the Sherman area. The 1 W. E. Stephens is to be a 6,500-ft. test about 4 miles northwest of the Sherman field in Edgar Meade Survey, A-895.

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today is carrying the greatest burden in the history of oil well drilling

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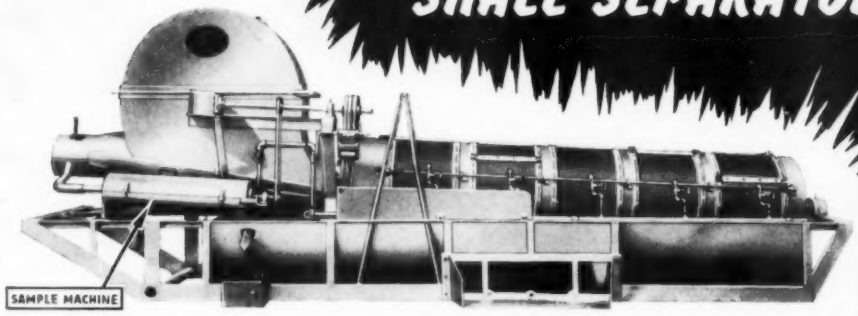

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Central Area

ILLINOIS

Casing has been run in Gulf Refining Co.'s prospective reef-discovery well in southwestern Clinton County, and preparations are being made for testing. The well, 1 Elmer Oelze, NW NE SW 3-1s-5w, is bottomed at 2,077 ft., 134 ft. in the Devonian-Silurian section, which carried good porosity and saturation from the top, logged at 1,943 ft. Bottom of the casing string is at 2,076 ft., 1 ft. off the total depth. Best saturation and porosity was logged at intervals at 2,029-55 ft. and 2,058-71 ft. A drill-stem test of the latter interval had gas at the top within 5 minutes and started spraying oil in 75 minutes. Oil flowed to the pits during the remaining 105 minutes the tester was open, and averaged 9 bbl. per hour. Recovery in the breakdown was 1,200 ft. of clean oil with 10 ft. of water.

Peak Drilling Co. and associates' 1 Brown, SE SE NW 8-3s-4e, which opens a new McClosky producing area 1½ miles southwest of the West Markham pool, in Jefferson County, is being put on the pump for completion after swabbing tests in which it produced an average of more than 17 bbl. of oil per hour. Pay is at 3,053-61 ft. with total depth at 3,063 ft. The area is 7 miles southeast of Mount Vernon.

Two miles east of the Irvington pool, northwestern Jefferson County, Ervin & Bassett Drilling Co. 2 Hartle, SW SW SW 19-1s-1e, prospective discovery well in a shallow Pennsylvanian sand at 1,030-84 ft., bailed 1 bbl. of oil per hour. Testing continues.

Discovery of a new producing area in White County is indicated by showings obtained by George Aubrey and associates in their 1 Brown, NW SW SW 11-5s-10e. Showings were in Aux Vases sand at 2,984-90 ft. where a drill-stem test, taking in an interval below 2,970 ft., flowed gas, and filled 450 ft. of clean oil and 450 ft. of oil-cut mud. Tester was open 3 hours. No water was evident. Casing has been run to 2,978 ft. The location, 5 miles south of Crossville, is 1½ miles south of the Phillipstown Consolidated pool.

ILLINOIS SUCCESSFUL WILDCATS

Clay County: J. H. Gilliam 1 Jones, NE SE NW 3-3n-8e, IP 36 bbl., Rosiclare 3,036-42 ft., TD 3,142 ft.

Gallatin County: Inland Producers 1 Allen, SE NW SW 8-8s-8e, IP 35 bbl., O'Hara 2,863-68 ft., TD 3,017 ft.

Shelby County: Lynch Oil Co. 1 Dove, NE NE SW 27-11n-4e, IP 105 bbl., Aux Vases 1,816-21 ft., TD 3,301 ft.

ILLINOIS WILDCAT FAILURES

Clay County: W. C. McBride 1 Berthold, SW SE NE 18-5n-7e, dry, TD 2,940 ft.

Clinton County: Paul Schoendienst 1 Glaser, SW SW NW 11-1n-3w, dry, TD 1,190 ft.

Edgar County: Walter Cook Association 1 Hixson, NW NW NW 20-14n-13w, dry, TD 927 ft.

Effingham County: Shulman Brothers 1 Wenthe, NE NE SE 14-7n-5e, dry, TD 2,547 ft.

Gallatin County: Dale Hopkins 1 Spencer et al., NW NW SW 6-8s-8e, dry, TD 2,998 ft.

Montgomery County: Columbus Exploration Co. 1 Hampton, NW SW SE 19-7n-3w, dry, TD 2,184 ft.

Gulf Refining Co. 1 Mueller, SW SW NE 6-10n-4w, dry, TD 1,962 ft.

Moultrie County: Sun Oil Co. 1 Vadakin, NE SW NE 11-12n-5e, dry, TD 2,148 ft.

Perry County: Pure Oil Co. 1 Loos, SW NE NW 32-4s-3w, dry, TD 2,840 ft.

Shelby County: E. H. Kaufman 1 James Millikin University, SE SW NW 1-12n-3e, dry, TD 1,901 ft.

Wabash County: Illinois Oil Co. 1 Abell, SW NW NE 36-2n-13w, dry, TD 1,850 ft.

INDIANA

Peak Drilling Co. recovered 1,800 ft. of clean oil with 425 ft. of salt water in a 30-minute drill-stem test of O'Hara lime oil showings at its 1 Felthaus, NE NE NW 2-6s-12w, an outpost in the area 3 miles north of St. Phillips, and 7 miles northwest of Evansville, in Posey County, near the Vanderburgh County line. O'Hara saturation was logged at 2,630-35 ft. Hole was deepened to 2,662 ft. and casing run through the zone to 2,657 ft. for completion.

Francis L. Beard has completed his 1 Horrall, in Military Donation 227-2n-8w, Knox County, as a 10-bbl. pumper from Rosiclare lime at 1,482-88 ft. The well extends production of the new Monroe City East pool. Total depth is 1,603 ft. with hole plugged back to 1,492 ft.

INDIANA SUCCESSFUL WILDCAT

Knox County: Francis L. Beard 1 Horrall, Military Donation 227-2n-8w, IP 10 bbl., Rosiclare 1,482-88 ft., TD 1,603 ft.

INDIANA WILDCAT FAILURES

Daviess County: National Associated Petroleum Co. 1 Whittmer, NE SW NW 11-3n-6w, dry, TD 1,190 ft.

Dubois County: Pure Oil Co. 1 Wiesehan, SW SE NW 12-3s-6w, dry, TD 1,200 ft.

Gibson County: Barron Kidd 1 Gibson County, SE SE NW 33-2s-10w, dry, TD 2,150 ft.

Putnam County: Hayes & Kennedy 1 Nichols, SW SE NE 17-14n-3w, dry, TD 2,375 ft.

Spencer County: Oil Management, Inc., 1 Wheelock, SW SW NE 22-6s-7w, dry, TD 1,625 ft.

Sullivan County: J. W. Everhart 1 McKain, SE SW NE 25-7n-10w, dry, TD 2,735 ft.

Delbert Runyon 1 Pigg, SW NW NW 29-8n-8w, dry, TD 2,221 ft.

Vigo County: T-H Corp. 1 McPeak, NW NW SW 35-10n-9w, dry, TD 2,215 ft.

MICHIGAN

Flow from Louis Rose 1 Brocht, N½ NE SE 2-20n-6w, Winterfield Township Richfield oil discovery, Clare County, was reported to be averaging 35 bbl. of fluid a day through tubing this week with a small water showing. Wildcat made one natural head flow of 47 bbl. through 5-in. casing after hole was deepened from 5,054-56 ft. last week. Total depth was reported to be 5,055 ft. last week, but this was corrected by new measurements. Oil pay in the Richfield started to show at about 5,048 ft.

After the head flow through casing, the well died. No production was reported while tubing was being run. First day after being tubed, well swabbed 4 bbl. of oil and 10 of water in less than 6 hours. Next swab-flow test showed recovery of 30 bbl. of oil and 17 bbl. of water, while the following day well flowed 25 bbl. of oil and 11 of water.

Water showing with the oil, after well had produced about 200 bbl. of fluid, was reported to be only 22 bbl.—far less than indicated on preliminary reports. On last 2 days of production well had produced 70 bbl. of fluid, of which only 4 bbl. was water. It is believed that this water is showing from a zone above the oil pay, and that it will exhaust itself in time. Preparations were being made to acidize the 1 Brocht with an initial 2,000-gal. shot this week end.

In addition to the south-offset location (40-acre offset) which will be drilled by Rose et al as announced last week, Sun Oil Co. was reported to have the direct west-offset location surveyed and staked this week for immediate drilling.

MICHIGAN WILDCAT FAILURES

Allegan County, Ganges Township: Ford Oil Co. 1 Targosz, SE SE SE 36-2n-16w, Traverse 1,185 ft., dry, TD 1,189 ft.

Arenac County, Mason Township: Frank E. Roush 1 Gibson, SW SW SW 24-20n-5e, Dundee 2,781 ft., dry, TD 2,976 ft.

Bay County, Pinconning Township: J. O. Mutch 1 Breu, NE NW SE 25-17n-4e, Dundee 2,794 ft., dry, TD 3,021 ft.

Kent County, Tyrone Township: James J. McGerry, Trustee 1 Schneider, SW SE SW 12-10n-12w, Traverse 2,338 ft., dry, TD 2,360 ft.

Mecosta County, Grant Township: John Neyer 1 Freiberg, SW SW NW 19-16n-9w, Dundee 3,580 ft., dry, TD 3,735 ft.

Muskegon County, Moorland Township: McClure Oil Co. 1 Baustert, SW SW NE 16-10n-14w, Dundee 2,363 ft., dry, TD 2,490 ft.

Osceola County, Middlebranch Township: Osceola Development Co. 1 Zinger et al, NW NW SW 20-19n-7w, Dundee 4,057 ft., dry, TD 4,283 ft.

Saginaw County, Birch Run Township: Triple W Development Co. 1 Kalmback, NW SE NW 19-10n-6e, Dundee 2,528 ft., dry, TD 2,560 ft.

Van Buren County, Arlington Township: Clapsaddle Drilling Co. 1 Cefcik, NW NW NW 5-2s-15w, Traverse 1,090 ft., dry, TD 1,114 ft.

Arlington Township: R. T. Jones 2 Tomcala, NW SE SE 34-2s-15w, Traverse 1,070 ft., dry, TD 1,082 ft.

Geneva Township: Orville Palmer 1 Hodgeman, NW NE NE 34-1s-16w, Traverse 1,087 ft., dry, TD 1,091 ft.

WESTERN KENTUCKY

W. E. Shaver and associates have gone back into an old hole, 1 McKinney, NW NW NW 20-O-18, north of the Spring Grove pool, Union County, and are preparing to run 5½-in. casing to test various potentially productive zones in the area. Hole was drilled in 1949 to 2,701 ft. and abandoned. Best prospects of production are believed to be in Tar Springs sand at 2,320-30 ft. Casing will be run through the latter zone to 2,570 ft. The location is more than a half mile from production. The area is 5 miles west of Morganfield.

WESTERN KENTUCKY WILDCAT FAILURES

Henderson County: J. L. Crawford 1 Clark, 4-O-22, dry, TD 2,722 ft.

Joe Bander et al. 1 Cates, NE SW SE 21-P-22, dry, TD 2,221 ft.

C. E. O'Neal et al. 1 Parrish, NE SE NW 17-P-25, dry, TD 2,455 ft.

Union County: Ashland Oil & Refining Co. 1 Thompson, NE SE NW 8-O-19, dry, TD 2,772 ft.

Louisiana-Arkansas

Prospective Oil Discoveries Watched in Two Parishes

SHREVEPORT.—A prospective discovery in Concordia Parish was running 7-in. casing to test oil shows in the Wilcox at 6,945-51 ft. Hunt Oil Co. and Gulf Refining Co. 1 L. D. Dale, C SE NW 29-4n-8e, is spotted in Dismal Swamp, about 7½ miles west of Fairview field and 3 miles northwest of Slocum. The test was drilled to 7,500 ft. in shale and sand. Two and one-half miles south and west, the same operators are drilling around 7,500 ft. at 2 L. D. Dale, C SE SW 42-4n-8e.

In Franklin Parish, McAlester Fuel Co. A-1 Leonal Clark has indicated new Paluxy sand production some 5 miles east of Mangham. The prospective strike, located in SE NW NE 7-15n-8e, ran a 6-minute drill-stem test at 4,003-06 ft., recovering 25 ft. of 43°-gravity crude and 30 ft. of oil-cut mud. Bottom-hole pressure flowing was 300 psi., and shut-in 5,175 psi.; ¼-in. top and bottom chokes were used during the test. Another test, of 25-minute duration, was run at 4,004-16 ft. with recovery being 240 ft. of 42°-gravity crude, 90 ft. of oil-cut mud, and 75 ft. of salt water.

Arkansas.—Garland Anthony Oil Co. will attempt to confirm production in Garland City (Paluxy pool opened earlier this year by Lee & Markham et al. 1 Price, C SE NW 18-16s-25w). The new venture, 1 E. A. Price, 430 ft. from the south and east lines of NW NE 18-16s-25w, Columbia County, is a north offset to the discovery. At last re-

(Continued on page 189)

Canadian Fields

Expanding Leduc Extended Southward

CALGARY.—The Leduc area is continuing to get extensions and new pool discoveries. This week Miller, Pyrcz & Roberts Oil Co. of Edmonton reported that its Penn-Leduc 2, in the southern sector of Leduc, discovered oil in the Lower Cretaceous horizon.

The well is located in LSD 9, 21-49-26w4, in a D2 oil area about 2 miles east of the Calmar area, the same distance west of McLeod pool, and about 1 mile south of Okalta's South Leduc D2-D3 Devonian oil pool. The indicated discovery is offset by a D2 oil producer on the west. Company officials reported that a 30-minute drill-stem test of the Lower Cretaceous interval at 4,541-49 ft. gave a flow of natural gas to the surface in 5 minutes, and a flow of oil in 15 minutes. Pipe recovery was 600 ft. of clean oil, no water. Penn 2, originally scheduled as a D2 Devonian venture, will be carried down as a test of that horizon. If the D2 is productive, a later well will likely tap the Cretaceous on that same site.

The team of Hudson's Bay Oil & Gas Co., Ltd., Union Oil Co. of California, and Texaco Exploration Co. was unable to make a commercial oil well at its wildcat in the Hamelin Creek area of Peace River, but plugged the well back to the Cadomin conglomerate formation and rated a sizable natural gas producer. It rates an initial potential of 66,000,000 cu. ft. of gas daily. The well, Hudson's Bay-Union-Texaco 1, in LSD 16, 29-80-6w6, is about 265 miles northwest of Edmonton. The team found gas and oil plus salt water in the Triassic, but was unable to complete the well as a commercial producer from that horizon, so hole was plugged back for production in the Cadomin. The large gas flow came from the perforated interval at 3,292-3,330 ft.

Canadian Delhi Oil, Ltd., has struck a flow of natural gas at its venture in the Countess-Southesk area of southern Alberta. This venture, located about 2 miles from Countess area gas wells, found its gas in the first sand of the Bow Island Sand series. A drill-stem test of the interval 2,905-20 ft. was run for 2 hours and 37 minutes. A flow of gas reached the surface in 30 minutes, blew the mercury out of the measuring gage, but engineers estimated the flow rate to be around 3,000,000 cu. ft. daily. The well, Delhi-Sun-Southesk 1, in LSD 11, 32-20-16w4, is now continuing to drill ahead.

Central Alberta's most recent promising oil discovery well, at Armena, is awaiting service rig prior to being placed on production, while the discovery team of Western Homestead Oils, Ltd., North Canadian Oils, Ltd., and Petcal, Ltd., has drilling under way at the first follow-up venture and has sites staked for another pair of offset drillers. The Armena strike was made in the Viking sand at a location 6 miles northwest of Camrose Viking oil wells and 10 miles southeast of Joseph Lake Viking field. The discovery, Homestead-North Canadian-Armena 2, completed drilling at 3,263 ft. after penetrating 14½ ft. of Viking oil-bearing water-free pay zone. String of production casing has been set, and service rig will likely be moved to location shortly.

CANADIAN SUCCESSFUL WILDCATS

Canadian Superior-Holt 15-36, LSD 15, 36-44-22w4, TD 4,955 ft., 232 bbl. daily through 11/64-in. choke.

H. B.-Union-Texaco 1, LSD 16, 29-80-6w6, TD 5,566 ft., 66,000,000 cu. ft. gas daily.

CANADIAN WILDCAT FAILURES

Canadian Fina et al.-Talbot 1, LSD 6, 14-38-10w4, TD 3,410 ft.

Imperial-Caslan 1, LSD 2, 18-63-17w4, TD 3,741 ft.

Cardinal-Admiral-Cessford 1, LSD 7, 19-23-12w4, TD 3,248 ft.

Imperial-Jarvie 3, LSD 7, 33-63-2w5, TD 3,177 ft.

Union Bow River 1, LSD 10, 4-13-13w4, TD 3,460 ft.

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Appalachian Fields

(Continued from page 177)

OHIO WILDCAT FAILURES

Knox County, Pike Township: Roy Stewart et al. 1 C. C. Harris, Lot 3, Clinton 2,700-01 ft., TD 2,729 ft.

Stark County, Lake Township: J. C. Steiner et al. 1 L. C. Brett, Sec. 20, Clinton 4,368-4,467 ft., TD 4,472 ft.

Statement of the Ownership, Management, Etc., of
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Known bondholders, mortgagees and other security holders holding 1 per cent or more of the total amount of bonds, mortgages or other securities: None.

S. H. ROURKE,
Business Manager.

Sworn to and subscribed before me this 1st day of October, 1951.

ROBERT D. FUNK,
Notary Public.

My commission expires April 19, 1955.

Service Company Organized

A joint service company has been organized by nine German oil firms which will base its work on experiences of American service companies. A sonoscope and tuboscope apparatus have been ordered from the United States and arrangements made for the construction of German equipment.

Elsewhere in the German oil-development field, reports on drilling meterage by the industry show that the total drilled during May amounted to 29,637 m. (about 97,500 ft.). This represented a decrease from the April total of 36,531 m., but exploratory drilling, included in the total, was up from 7,406 m. in April to 8,607 in May. Results of recent drilling in Western Germany include the discovery of a third producing horizon in the Gigas formation of the Upper Jurassic in 3 Suderbruch. The well was drilled in Suderbruch field which is jointly owned by Gewerkschaft Brigitta and Deutsche Vacuum Oel, AG. Further testing was planned to determine the importance of the new horizon.

La.-Ark. Fields

(Continued from page 187)

port the well was drilling below 2,650 ft. toward objective depth of 3,800 ft.

In the same county, McAlester Fuel has plugged its 1 Gean, Smackover wildcat, at total depth of 7,800 ft. The failure is located 2½ miles northeast of Magnolia, in SE SW 6-17s-20w. A drill-stem test at 7,684-97 ft. in limestone recovered water cushion, 270 ft. of oil, water, and gas, 180 ft. of gas and oil cut with salt water, and 270 ft. of salt water. The Smackover was topped at 7,660 ft., with porosity logged at 7,692 ft.

NORTH LOUISIANA WILDCAT FAILURES

Catahoula Parish: Hunt Oil Co. and Gulf Refining Co. 64 Louisiana Delta Lumber Co., C NW SW 20-4n-5e, dry, TD 7,000 ft.

Placid Oil Co. 3 Farrier, 1,810 ft. S and 660 ft. E NWc NE 34-4n-6e, dry, TD 7,515 ft.

Claiborne Parish: R. J. Caraway et al 1 Spurlock, C NW SW 24-19n-6w, dry, TD 9,813 ft.

Concordia Parish: Richardson & Bass 1 Madison Oil & Gas Co. "C," 1,375 ft. S and 2,110 ft. E NWc 22-6n-8e, dry, TD 8,026 ft.

Barnett Serio et al 1 Gibson, 2,060 ft. S and 909 ft. E NWc 7-7n-7e, dry, TD 5,504 ft.

ARKANSAS SUCCESSFUL WILDCAT

Union County: Pan-Am Southern Corp. 1 Ezzell, NW SW SE 13-17s-15w, 23 bbl. oil from Cotton Valley at 5,026-28 ft., TD 6,366 ft.

ARKANSAS WILDCAT FAILURES

Lafayette County: E. G. Bradham 1 Cooper-Cook, 200 NW C SW SE 3-17s-23w, dry, TD 8,389 ft.

Miller County: J. H. Buchanan 1 McIver, 560 ft. N and 355 ft. W SEc SW 6-16s-26w, dry, TD 3,529 ft.

Ouachita County: Anthony Drilling Co. 1 Browning, SE SE SW 31-14s-17w, dry, TD 3,000 ft.

Union County: Shell Oil Co. 4 U. S. M., NE SW NE 31-17s-11w, dry, TD 6,100 ft.

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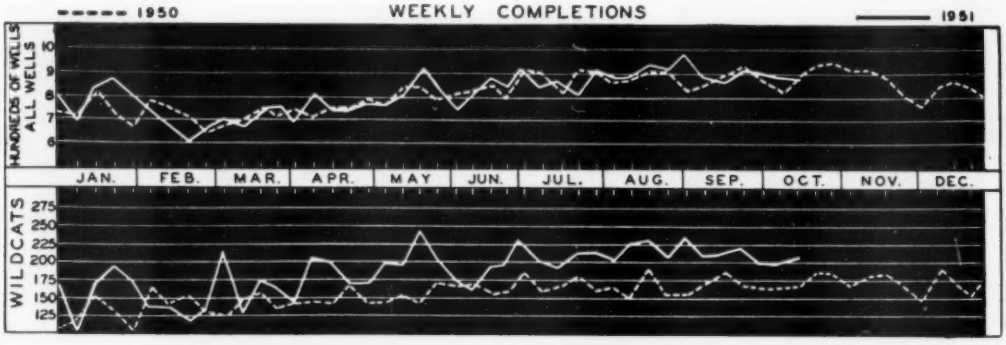
CURRENT STATISTICS

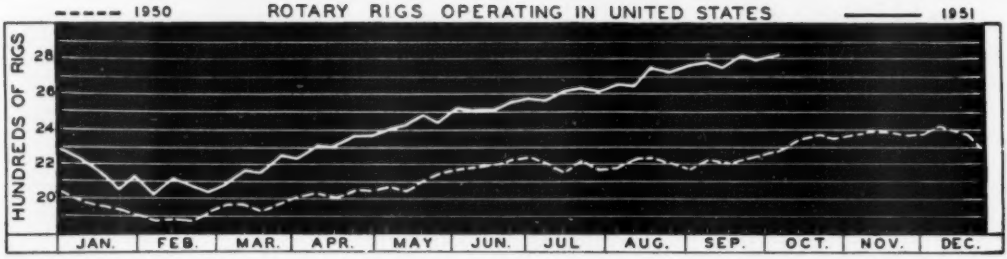
EXPLORATION

WEEKLY WELL COMPLETIONS . . . WEEK ENDED OCTOBER 13, 1951

	Total of all wells					Oct. 13		Wildcat completions and discoveries									
													Cumulative total, 1951				
	Comp.	Oil	Gas	Dry	Footage	1951	1950	Oil	Dist.	Gas	Dry	Total	Oil	Dist.	Gas	Dry	Total
New York	13	7	0	*6	19,136	515	554	0	0	0	0	0	0	0	0	0	0
Pennsylvania	37	14	10	†13	65,944	1,152	1,076	0	0	0	0	0	0	0	0	1	1
West Virginia	15	1	12	2	42,350	477	526	0	0	0	0	0	0	0	9	6	15
Ohio	22	5	7	‡10	37,668	749	799	0	0	0	2	2	1	0	5	20	26
Indiana	37	11	0	26	70,563	1,036	1,260	1	0	0	8	9	38	0	1	285	324
Kentucky	42	13	0	29	73,664	965	893	0	0	0	3	3	21	0	1	124	146
Illinois	40	17	0	23	106,637	1,846	2,186	3	0	0	11	14	61	0	0	437	498
Michigan	15	2	0	13	35,591	607	695	0	0	0	11	11	21	0	7	238	266
Kansas	87	43	11	33	323,310	3,428	3,038	3	0	0	23	26	162	1	13	682	858
Nebraska	6	2	0	4	24,032	182	88	1	0	0	4	5	9	0	1	91	101
Oklahoma	98	45	9	‡44	331,302	4,359	4,243	4	0	1	13	18	146	4	18	562	730
Texas	307	183	16	108	1,524,761	13,047	12,874	15	2	3	64	84	583	46	94	2,688	3,411
North Central (Dist. 7-B & 9)	88	43	0	‡45	290,649	3,954	3,921	10	0	0	27	37	283	2	12	1,150	1,447
West (Dist. 7-C & 8)	94	73	0	21	510,601	3,947	3,870	3	1	0	14	18	145	10	6	506	667
Panhandle (Dist. 10)	16	6	8	2	55,769	587	726	0	0	0	1	1	2	0	0	22	24
Eastern (Dist. 5 & 6)	21	18	0	3	128,553	942	895	0	0	0	0	0	9	8	0	180	197
Gulf Coast (Dist. 2 & 3)	51	34	6	21	348,491	1,818	1,797	1	1	2	14	18	74	18	48	382	522
Southwest (Dist. 1 & 4)	37	19	2	‡16	190,698	1,819	1,665	1	0	1	8	10	70	8	28	448	554
Louisiana	54	29	4	21	355,918	1,689	1,924	0	1	0	9	10	31	9	7	226	273
Northern	30	15	3	12	108,882	¶927	1,030	0	0	0	5	5	9	0	4	136	149
Southern	24	14	1	9	247,036	762	891	0	1	0	4	5	22	9	3	90	124
Arkansas	11	8	0	3	44,323	¶322	321	1	0	0	3	4	13	1	3	66	83
Mississippi	7	1	0	6	48,430	280	248	0	0	0	4	4	12	3	0	114	129
Southeastern States	1	0	0	1	4,000	44	48	0	0	0	1	1	0	0	0	21	21
Montana	9	7	1	1	16,152	176	194	0	0	0	0	0	0	0	0	39	39
Wyoming	13	11	0	2	80,980	585	459	0	0	0	0	0	12	0	1	92	105
Colorado-Utah	12	2	0	10	64,131	229	73	0	0	0	8	8	7	0	4	110	121
New Mexico	7	2	1	4	42,675	517	491	0	0	0	2	2	16	0	8	59	83
California	47	37	1	9	197,876	1,805	1,396	1	0	0	6	7	41	0	4	356	401
Miscellaneous	0	0	0	0	0	50	43	0	0	0	0	0	1	0	20	22	43
Total United States	880	440	72	368	3,509,443	34,069	33,429	29	3	4	172	208	1,175	64	196	6,239	7,674
Total previous week	888	458	75	355	3,478,695			28	1	1	163	193	1,146	61	192	6,067	7,466
Total October 13, 1951	894	484	64	346	3,268,136			30	1	7	130	168	862	61	167	4,997	6,107

Service wells included: *8, †12, ‡2, §7. ¶Revised.





DAILY AVERAGE PRODUCTION FOR WEEK

	Oct. 13 crude oil	B. of M. Oct. demand	Oct. 6 crude oil
Alabama	2,900	2,400	3,050
Arkansas	77,600	85,000	77,300
California	987,300	980,000	986,200
Colorado	75,800	77,000	78,300
Eastern	60,350	62,000	58,500
Florida	1,675	1,600	1,550
Illinois	167,400	165,000	169,100
Indiana	32,200	31,000	32,300
Kansas	312,100	320,000	332,600
Kentucky	31,800	31,000	32,200
Louisiana	618,400	664,000	619,325
North Louisiana	113,350	.....	113,150
South Louisiana	505,050	.....	506,175
Michigan	39,200	40,000	37,100
Mississippi	103,240	105,000	100,335
Montana	24,800	26,000	25,000
Nebraska	7,500	8,000	7,400
New Mexico	144,775	156,000	144,775
Oklahoma	507,100	530,000	506,500
Texas	2,864,475	2,720,000	2,859,200
Dist. 1 (Southwest)	34,725	.....	34,550
Dist. 4 (Southwest)	267,700	.....	266,525
Dist. 2 (Gulf Coast)	172,300	.....	171,475
Dist. 3 (Gulf Coast)	493,350	.....	492,400
Dist. 5 (Eastern)	55,075	.....	55,375
Dist. 6 (Eastern)	119,625	.....	119,375
East Texas field	270,500	.....	271,450
Dist. 7-C (West)	111,000	.....	110,625
Dist. 8 (West)	1,007,600	.....	1,005,500
Dist. 7-B (W. Central)	86,875	.....	86,400
Dist. 9 (N. Central)	161,500	.....	161,225
Dist. 10 (Panhandle)	84,225	.....	84,300
Utah	3,900	5,000	3,900
Wyoming	188,000	188,000	187,300
Total United States	*6,250,515	6,197,000	6,261,935
Change from prev. week, down	11,420		
Canada	164,085	.....	109,900

Total U. S. production January 1-October 13 .. †1,746,663,765 bbl.
Same period last year (crude plus cond.) ..... 1,518,942,840 bbl.

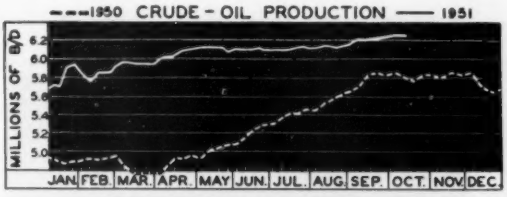
*Not including 104,990 bbl. condensate. †Including 30,024,050 bbl. condensate.

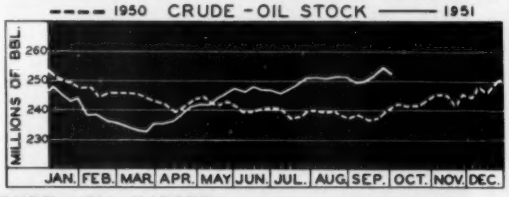
CRUDE-OIL STOCKS BY STATES OF ORIGIN*

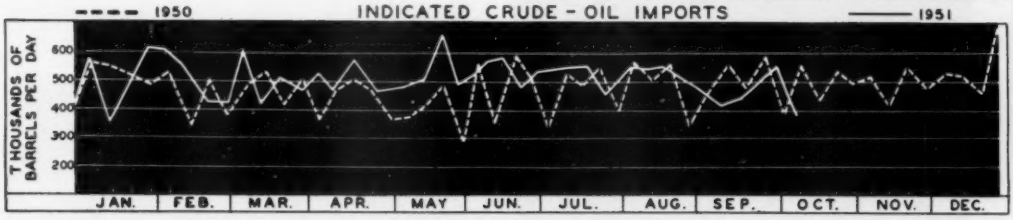
(Thousands of barrels)

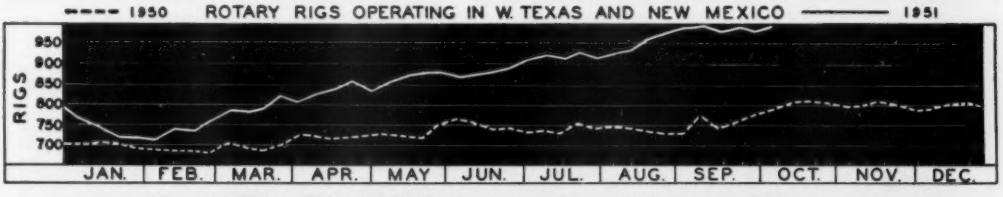
	Oct. 6, 1951	Sept. 29, 1951	Oct. 7, 1950
Pennsylvania Grade	1,996	2,130	2,370
Other Appalachian	1,702	1,734	1,348
Illinois, Indiana, Michigan	13,316	12,702	9,983
Arkansas	2,647	2,791	2,903
Louisiana	14,966	15,628	14,647
North	2,748	2,722	3,197
Gulf	12,218	12,906	11,450
Mississippi	3,245	3,249	2,380
New Mexico	6,993	6,853	6,315
Oklahoma and Kansas	38,350	38,552	36,239
Texas	121,818	121,939	117,348
East Texas	15,470	15,013	14,156
West Texas	50,777	51,740	46,267
Texas Gulf	26,443	25,913	28,349
Other Texas	29,128	29,273	28,576
Rocky Mountain	13,488	13,081	10,563
California	29,313	29,652	31,014
Foreign	6,201	7,208	6,101
Total	254,035	255,519	241,211

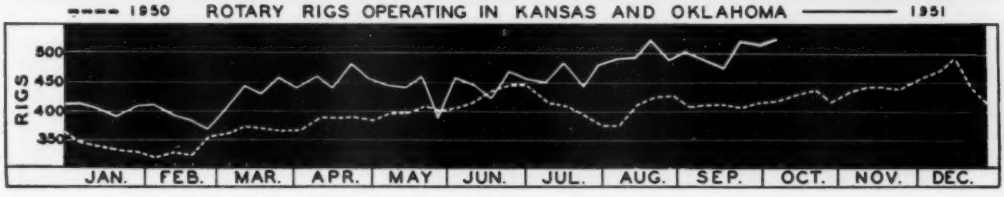
*Bureau of Mines.









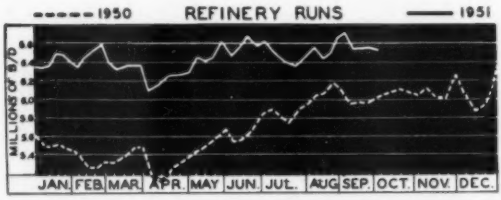


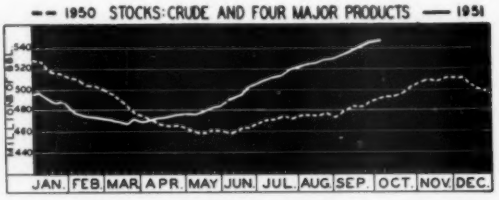
A.P.I. REFINERY REPORT, OCTOBER 6

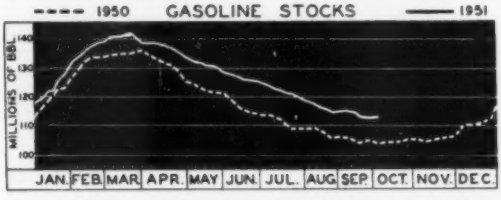
(Thousands of barrels)

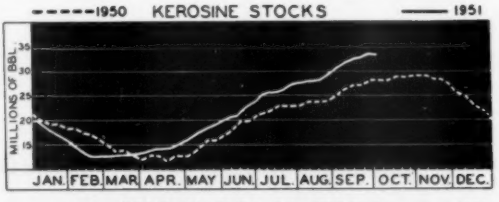
District—	Daily avg. crude runs	Daily average production				Stocks at refineries, bulk terminals, in transit and in pipe lines				Bureau of Mines, October 1950				
		Gasoline*	Kerosine	Distillate	Residual	Gasoline†	Kerosine	Distillate	Residual	Daily avg. crude runs	Daily average production			
											Gasoline*	Kerosine	Distillate	Residual
East Coast	1,025	397.1	42.3	262.7	219.4	24,563	12,068	33,933	11,931	937	369.8	38.5	226.1	202.0
Appalachian:														
District 1	111	48.3	5.9	20.1	11.6	2,880	656	1,070	703	102	43.6	6.4	14.2	11.0
District 2	33	31.1	3.6	9.0	5.9	1,395	329	461	197	70	33.1	4.8	6.6	14.1
Ind., Ill., Ky.	1,104	584.2	58.1	191.1	156.0	23,469	7,651	21,232	6,120	1,086	572.9	62.9	190.6	155.4
Okla., Kans., Mo.	527	303.1	29.8	113.4	63.1	11,935	1,962	11,106	2,049	494	281.9	15.7	108.9	58.6
Inland Texas	271	167.0	12.6	40.1	39.7	3,849	622	1,828	1,255	215	146.4	12.7	31.8	39.2
Texas Gulf Coast	1,553	713.3	137.7	357.2	216.3	17,434	5,452	12,693	6,622	1,505	675.9	106.2	347.7	283.0
La. Gulf Coast	536	251.3	67.4	132.9	54.9	6,026	3,279	3,582	2,175	483	228.1	57.2	104.8	68.5
N. La. and Ark.	84	34.3	7.4	19.1	6.3	2,945	614	1,087	189	77	26.4	7.3	18.0	6.8
Rocky Mountain:														
New Mexico	14	7.7		2.9	3.9	115		75	40	14	7.3	.3	2.6	3.3
Other Rocky Mtn.	214	93.7	6.0	38.9	37.0	3,517	416	2,132	1,084	170	78.6	6.9	31.3	39.4
California	1,044	432.6	8.6	145.3	375.1	14,575	635	8,999	15,601	924	410.7	12.2	134.3	369.0
October 6, 1951	6,536	3,063.7	379.4	1,332.7	1,190.9	112,703	33,704	98,198	47,966	6,077	2,874.7	331.1	1,216.9	1,250.3
September 29, 1951	6,558	3,012.1	364.1	1,303.4	1,190.3	112,356	33,837	196,695	‡47,893	.....	.....	.....	.....	.....
October 7, 1950	6,091	2,751.3	320.0	1,207.0	1,165.1	103,700	28,170	78,601	42,213	.....	.....	.....	.....	.....

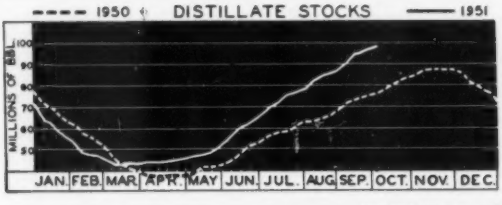
*At refineries including natural blended. †Finished and unfinished. ‡Revised in California.

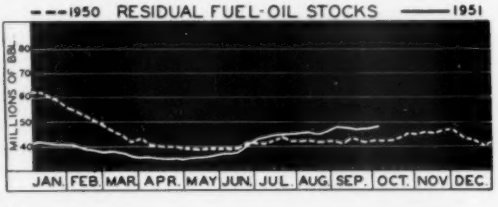


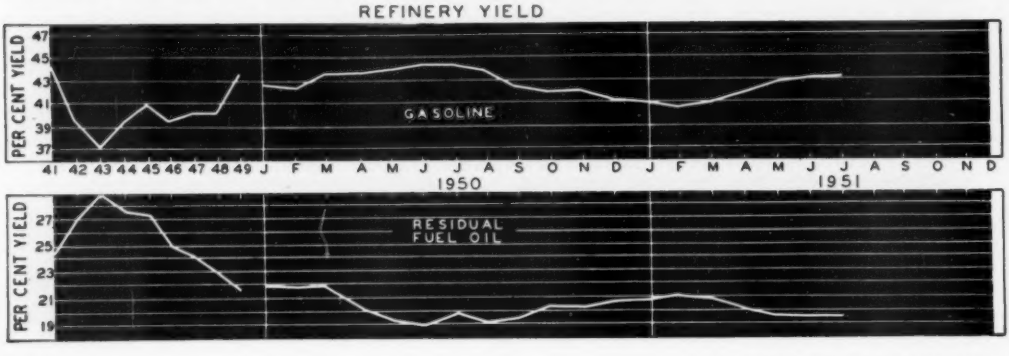











REFINERY YIELD
PER CENT YIELD
GASOLINE
41 42 43 44 45 46 47 48 49 J F M A M J J A S O N D J F M A M J J A S O N D
1950
1951
PER CENT YIELD
RESIDUAL FUEL OIL

CRUDE PRICES
GRAVITY SCHEDULE

	Signal Hill, Calif.‡	Oklahoma, Kansas	Gulf Coast Tex.*	West Tex.†
18-18.9	$1.93	....	....	....
19-19.9	1.98	....	....	....
20-20.9	2.03	$2.25	....	$2.12
21-21.9	2.07	2.27	....	2.14
22-22.9	2.12	2.29	....	2.16
23-23.9	2.18	2.31	....	2.18
24-24.9	2.24	2.33	$2.56	2.20
25-25.9	2.30	2.35	2.58	2.22
26-26.9	2.36	2.37	2.60	2.24
27-27.9	2.41	2.39	2.62	2.26
28-28.9	2.46	2.41	2.64	2.28
29-29.9	2.52	2.43	2.66	2.30
30-30.9	2.57	2.45	2.68	2.32
31-31.9	2.62	2.47	2.70	2.34
32-32.9	2.68	2.49	2.72	2.36
33-33.9	....	2.51	2.74	2.38
34-34.9	....	2.53	2.76	2.40
35-35.9	....	2.55	2.78	2.42
36-36.9	....	2.57	2.80	2.44
37-37.9	....	2.59	2.82	2.46
38-38.9	....	2.61	2.84	2.48
39-39.9	....	2.63	2.86	2.50
40 and above	....	2.65	2.88	2.52

*For crude from Daboval, El Campo, and Sand Point.

†Includes Lea County, New Mexico. Last general price change represented a 50-cent increase becoming effective December 6, 1947.

‡Standard Oil Co. of California.

FLAT CRUDE PRICES

Representative posted schedules per barrel.

East Texas†	$2.65
Kettleman Hills, California*	2.80
Beauregard Parish	2.60
Illinois Basin	2.77
Pecos County, Texas (Yates)	2.35
Bradford, Pennsylvania	4.25
Eastern Ill. and Western Ind.†	2.77
Tomball, Texas Gulf Coast	2.83

*37°-37.9°. †35° and above.

HEAVY fuel on the Group 3 market lost a little of its softness during the second week of October. The slight change was not enough to indicate a trend and was probably due to some easing in the over-all storage problem through tank-car shipments to the Gulf Coast. Stocks of residual in the Oklahoma - Kansas - Missouri refining district totaled 2,049,000 bbl. on October 6, an increase of only 112,000 bbl. in the past 3 weeks. Suppliers report an increase in inquiries for heavy fuel in the past week, but most of these are for shipment after the end of the month.

Most operators feel that, if near-normal movement of residual from refineries in the Mid-Continent can be maintained throughout the remainder of this month, increased demand in November will start the winter draft on stocks. Mid-Continent inventories reached 3,250,000 bbl. at the end of October 1948 or 1,200,000 bbl. greater than on October 6 this year. Current rates of residual production in the district are not high enough to boost inventories to the 1948 peak even with lower-than-normal shipments between now and the end of the month.

Other major product stocks in the Mid-Continent changed very little in the 3-week period ended October 6 with small increases for kerosine and distillate balanced by a reduction in gasoline inventories.

Group 3 gasoline market is at least as firm as it was at the end of August despite relatively high stocks.

Refinery and terminal prices for gasoline on the East Coast remain near normal, but the price war at tank-wagon and service-station levels in eastern Pennsylvania and southern New Jersey is worse. Atlantic Refining Co. announced another cut in its Philadelphia dealer tank-wagon price to 8.9 cents for regular gasoline, 5.8 cents under normal posting, to meet competition.

REPRESENTATIVE QUOTATIONS

Representative spot-market quotations of leading suppliers as of October 15, 1951. Figures are f.o.b. plant for tank-car shipments in cents per gallon, except for residual fuel oil which shows the price per barrel and wax, in cents per pound.

GASOLINE, KEROSINE, AND FUEL OILS

	Mid-Continent Group 3	New York Harbor (barge)	Texas Gulf Coast
Regular gasoline, 80-82 octane	10¼-10½	12-12.75	10¾-11
Premium gasoline, 86-88 octane	11¼-11½	13.5-13.75	11¾-12
42-44 w.w. kerosine	9-9⅜	10	9
No. 2 straw fuel oil	8-8½	9	8
No. 6 residual	$1.65-1.75	$2.45-2.60	$1.75-1.90

NATURAL GASOLINE

	Group 3	North Texas	N. La.
Grade 26-70	6⅞	6⅜	6⅜
Grade 18-55	8.25	7.75	8.0

LUBRICATING OILS

South Texas

200 vis., No. 2-3 neutral	13-13.5
750 vis., No. 3-4 neutral	16
2,000 No. 5-6 neutral	18-19

LUBRICATING OILS

Mid-Continent

150-160 vis., D bright stock, 0-10 pp.	29-30
200 vis., No. 3 neutral, 0-10 pp.	17.5-18.5

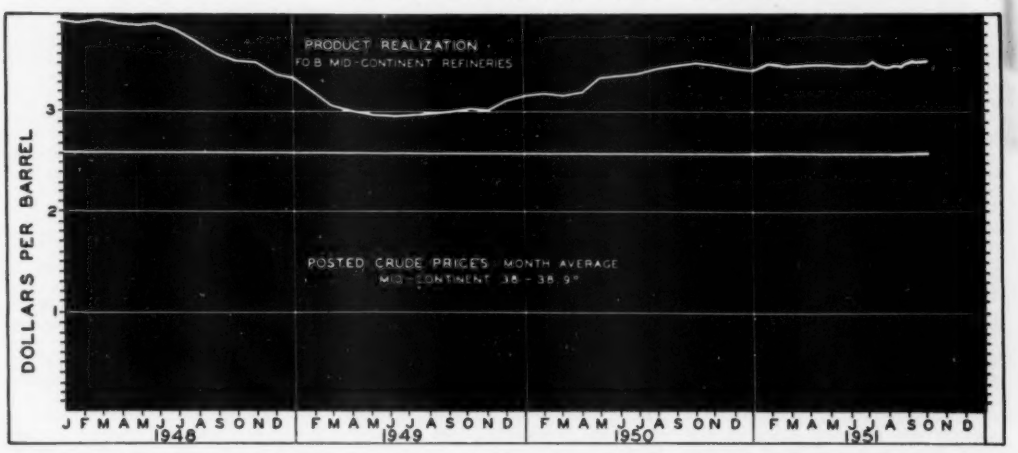
Western Pennsylvania

145-155 vis., 10 p.t. bright stock	32.5
180 vis., 0 p.t. neutral	31.5

WAX

Mid-Continent

132-134 A.M.P.	6.0



In this trend chart refinery realization is based on average Mid-Continent grade crude oil (not 38° gravity only) and average prices for refinery products as published in The Oil and Gas Journal basis Oklahoma (Group 3). Refinery yields confined to gasoline, kerosine, distillate, and fuel oil. Realization averaged $3.54 for week ended October 6, $3.53 for previous week, and $3.50 for October 1950.

EQUIPMENT MEN . . . in the News

Guiberson Holds Fall Sales Meeting in Dallas

Guiberson Corp. held its fall sales meeting in Dallas, September 27-28 with more than 35 sales representatives and executives of the corporation attending.

H. S. ZANE

A. P. SMITH

One of the principal events at the meeting was a clinic on gas-lift installations with the Guiberson Type "A" flow valve. Two new packers, Type "WF" water flood and Type "H" hydraulic hold-down anchor were introduced and discussed.

Harry S. Zane, Jr., sales manager for the corporation, in conducting the meeting said: "The advanced design and the unique performance in either intermitting or continuous flow of the Guiberson Type "A" flow valve is now well accepted by the industry. Demand and sale of all gas-lift equipment has greatly increased during 1951."

Alex P. Smith, executive vice president and general manager for Guiberson, told the group: "Our production of equipment is keeping pace with the high demand of the industry and sales continue to climb."

Texas Industries, Inc., Moves Into New Quarters

Home offices of Texas Industries, Inc., successor to Texas Lightweight Aggregate Co., and supplier of much of the Haydite aggregate used in refractory concrete, have been established in new quarters in the First National Bank Building, Dallas.

Lightweight Haydite aggregate is processed in four plants owned by Texas Industries. Eight other subsidiaries manufacture light-weight Texcrete masonry building units.

Haydite is used in Lumnite-Haydite refractory concrete in virtually every refinery and chemical plant in the world. It is a very light, hard, cellular aggregate processed from certain clays and shales found at surface in Texas and Louisiana. In combination with Lumnite cement, developed by Universal-Atlas, it produces a refractory concrete which can withstand temperatures to 2,000° F., and the addition of expanded-type ore aggregate, such as exfoliated mica, raises temperature resistance to 2,400° F.

The four Haydite processing plants of Texas Industries, located at Rosenberg, Eastland, and Stafford, Tex., and Alexandria, La., have a combined production capacity of more than 400,000 cu. yd. a year.

Principal uses for the aggregate are in the manufacture of light-weight Texcrete masonry building units (40 per cent lighter than conventional concrete units) and in monolithic concrete construction.

G. A. Burns Named to Advisory Committee

G. A. Burns, vice president and manager of the oil-equipment division of Butler Manufacturing Co., Kansas City, has been named to the Heavy Metal Tanks Industry Advisory Committee of the National Production Authority.

As a member of the advisory committee, Burns will work with other industry leaders in furthering the nation's defense effort and in working out the problems of civilian and defense allocation of materials.

Burns has been with Butler since 1913, and has been prominently associated with oil industry activities during the past several years.

Pfaudler Names Bramer Sales Representative

A. C. BRAMER

The Pfaudler Co. has appointed Albert C. Bramer field-sales representative in the St. Louis territory, replacing B. E. Albair, who has resigned. Bramer, formerly a sales engineer in the company's chemical-sales division, will cover Missouri, Kansas, Arkansas, Oklahoma, and southern Illinois.

Clarence E. Avery and Robert H. Markert have been assigned to Pfaudler's New York City office.

Personnel Changes are Announced by Ideco

E. F. SHIELS

Geo. W. Walton, vice president of the Ideco Division of Dresser Equipment Co., has announced the following appointments: E. F. (Gene) Shiels has been named domestic sales manager, succeeding Tom A. Ramey, recently resigned; Gordon G. Wilbur as assistant export sales manager, and Dan Duncan as research engineer for Ideco's oil-field division.

Shiels, an engineering graduate of Texas A. & M. College, joined Ideco as a sales engineer in 1946. Since 1949 he has been technical-service manager at Dallas.

Wilbur is a graduate of the petroleum-engineering school at Oklahoma University and during the past 12 years has filled various key positions in the sales, technical service, and export divisions of Ideco.

Duncan began his career as a driller, and for many years worked as an engineer for major drilling contractors and oil-well drilling-equipment manufacturers.

Totco Appoints Two Service Engineers

W. H. (Pete) Peters, vice president of Technical Oil Tool Corp., Ltd., has announced the recent appointment of two new service engineers in the Mid-Continent area. Jack G. Henderson has been added to the Odessa staff, and he will work in that area under the direction of F. E. Sievers. G. G. (Bud) Gibbs will service the North Texas area covering Wichita Falls, Nocona, and Graham. He will assist R. K. Palmer.

White Motor Names Clarke To Divisional Sales Post

Robert F. Black, president of White Motor Co., has advised the appointment of Roderick H. Clarke as sales manager of its Sterling division. Clarke will make his headquarters in Milwaukee.

Clarke has had wide experience in the truck-transportation field. He was formerly with the Autocar Co. as district sales manager for Southern California, and as assistant to the president.

Western Co. Executives Named as Vice Presidents

J. E. COOPER

Five executives of Western Co., Midland, Tex., have been elected to the office of vice president, and a sixth has been appointed to fill a newly created office of treasurer and assistant secretary, it has been announced by H. E. Chiles, Jr., president.

Those who were elected to the office of vice president include John

C. L. GLASS

WALTER BEADLE

Ed Cooper, senior vice president and general sales manager; C. L. Glass, financial vice president and secretary; Walter Beadle, vice president of acidizing and allied-services division, and W. M. Osborn, vice president and geological advisor. R. E. Cox was named treasurer and assistant secretary.

R. E. COX

J. F. YOUNGER

Cooper joined Western Co. as sales manager in 1945, and has been a vice president of Western for approximately 1 year.

Glass, in his new capacity, will direct all of the financial operations of the company.

Beadle will continue to direct the acidizing service of the company's nine stations, and in addition he will be in charge of Western's geological chemical - engineering service, the chemical - engineering-research laboratory and other allied services.

John F. Younger will direct the activities of Western's bullet and jet-perforating service, perforating-research and development laboratory and all services which require the use of a wire line.

Osborn, in his capacity as vice president and geological advisor, will act as consultant for Western's geological section.

Cox will supervise all of Western's accounting operations.

E. F. Snyder Named Oil Aggregates Distributor

Panacalite Pacific Corp. has appointed E. F. Snyder of Long Beach, Calif., exclusive distributor of Panacrete and Panaseal. This representation will facilitate the distribution of these two light-weight oil aggregates which are used in oil-well cementing and in combating lost - circulation problems.

Snyder previously acted as assistant superintendent for E. B. Hall Co. of Wilmington, Calif., having been associated with this firm since 1937.

Kurt Taves, formerly representative in California for Great Lakes Carbon Corp. and for a number of years associated with International Cementers, Inc., is sales manager for Snyder. Assisting Taves in the California area is Clark Akin.

Casper Named Manager of A-C Power Department

Combining of the electrical and mechanical-power department of Allis-Chalmers Manufacturing Co., into a power department under the management of R. M. Casper has been announced by J. L. Singleton, vice president of the company's general machinery division.

Casper has been manager of Allis-Chalmers' electrical department since 1949. He joined the company in 1936 as a sales representative in the Detroit office and in 1942 was named sales engineer in charge of motor and generator sales in Allis - Chalmers electrical department. In 1947 he became manager of the motor and generator section.

New power - department appointments include: F. W. Bush, assistant manager in charge of the electrical sections; C. C. Jordan, assistant manager in charge of the mechanical sections; R. N. Miers, manager of the steam-turbine section; C. R. Braun, assistant to R. M. Casper; and E. J. Schiebenes, office manager of the power department.

Gates Moves to New Office

Early in September the warehouse and industrial sales office of The Gates Rubber Co. Sales Division, Inc. moved into its new location at 814 Northwest Fourth Street, Oklahoma City.

Lincoln Electric Appoints New Chief Engineer

L. K. Stringham has been appointed chief engineer for Lincoln Electric Co., Cleveland.

Stringham, an electrical engineer and graduate of Cornell University, has been with Lincoln since 1933 and has worked continuously in the engineering department. He has worked on the design of welding machines as well as electrodes and fluxes for both manual and automatic welding. He has also been responsible for the development of equipment for the manual and semiautomatic application of this welding process.

For the past 2 years he has been director of welding development. He is also on the board of directors.

Allis-Chalmers Elects Five New Officers

The election of five new officers and advancement of three other officers of Allis-Chalmers Manufacturing Co. was announced recently by W. A. Roberts, president of the firm.

Four new vice presidents were elected by the board of directors. W. G. Scholl, general sales manager of the tractor division, was named vice president in charge of sales for the tractor division and C. W. Schweers, director of sales in the general machinery division, was named vice president in charge of sales for that division.

J. F. Roberts, director of engineering in the general machinery division, was named vice president in charge of engineering for the division, and W. A. Yost, manager of the mechanical - power department, was named a vice president of the general-machinery division.

G. F. Langenohl, assistant treasurer, was elected treasurer and appointed assistant secretary. N. D. Johnson, assistant secretary, will continue to serve in that capacity and assume additional responsibilities as assistant treasurer.

Two new assistant comptrollers were also named. They are E. J. Dietrich, assistant to the controller, and T. D. Lyons, works controller.

Allis-Chalmers Names Two Directors, Vice President

Election of J. L. Singleton, vice president in charge of the general machinery division, and R. S. Stevenson, vice president in charge of the tractor division, to the board of directors of the Allis-Chalmers Manufacturing Co. was recently announced by W. A. Roberts, president. They succeeded as directors the late Walter Geist and W. C. Johnson.

Roberts also announced the appointment of W. E. Hawkinson, sec-

retary and treasurer of the company, as a vice president, secretary, and treasurer.

Singleton entered the Allis-Chalmers graduate training course in 1926 and was employed in various departments before going to the general machinery sales office in Denver in 1930. A succession of promotions followed until 1947 when he was named vice president and director of sales for the general machinery division, and early in 1951 he was named vice president in charge of the entire division.

Stevenson joined Allis-Chalmers as a salesman in the Kansas City tractor branch office in 1933 and 2 years later was named assistant manager of the company's branch in Omaha. He has served as assistant Southwest territory manager in Milwaukee, manager of the Northwest territory, Southwest territory manager, assistant general sales manager, and in February 1950 he was promoted to general sales manager of the tractor division, and was named vice president in charge of the tractor division early in 1951.

Mid-Continent Opens New Store at Sterling, Colo.

Additional service to the Rocky Mountain oil industry is now being provided by Mid-Continent Supply Co. through its new field supply store at Sterling, Colo. This is the second Mid-Continent store in the area, the other being located at Casper, Wyo., district headquarters for the company's Rocky Mountain operations.

Ken W. Davis, president and general manager, has announced that S. A. Worrall will manage the Sterling store. H. T. Branum and J. D. Bell have been appointed as field salesmen. Worrall had been located in Sterling as field representative prior to being appointed manager. Branum was transferred to his new position from Eunice, N. M., and Bell came to Sterling from the Casper, Wyo., location.

Other Sterling personnel includes W. E. Phillips, W. L. Ross, and H. D. Weaver as storemen, under the supervision of R. L. Harris, district manager.

Andrews Named to Board

Forrest Lee Andrews, of the law firm, Andrews, Kurth, Campbell & Bradley, Houston, has been elected to the board of directors of Plastic Coating Corp., Houston.

Emrich Co. Named Distributor

William E. Sievers Corp., Long Beach, Calif., distributors for Kingseal, a new lost-circulation additive, announces the appointment of James E. Emrich Co. as agent for Kingseal in the Casper, Wyo., territory.

Conoflow Expands Services With New Auxiliary Plant

R. B. Werey, president of Conoflow Corp., Philadelphia, has announced the opening of an auxiliary plant to enlarge its manufacturing facilities in the Philadelphia area.

Having outgrown its present location due to increased production, Conoflow has arranged to lease a two-story building in close proximity to the main office and factory. Plant No. 2 is being completely refurbished to accommodate the assembly and shipping division. The move will take place the latter part of October.

Dowell Names Groom Assistant Sales Manager

Claude H. Groom of Dowell Incorporated, Tulsa, has been promoted to assistant sales-development manager of that company.

Groom, who has been associated with Dowell and its parent organization, Dow Chemical Co., since 1936, formerly was a development engineer in Dowell's industrial division. In 1936 he joined Dow Chemical's staff in the organic-research laboratories in Midland, Mich. In 1945, when Dowell established its extensive research laboratories in Tulsa, Groom was transferred there in the capacity of technical advisor on industrial problems.

Dominion Installs Largest Stress-Relieving Furnace

Dominion Bridge Co., one of the first companies to install industrial X-ray and stress-relieving equipment for the manufacture of Class 1 pressure vessels, fire tube and water tube boilers and similar weldments, has supplemented its Lachine plant with a still larger structure, which ranks among the largest in North America.

The new furnace, designed by the company's Lachine staff, is 85 ft. long, 18 ft. high, and 18 ft. wide. These dimensions permit the sectional stress relief of refinery towers and similar vessels up to the largest sizes.

By using the old furnace for the stress relief of smaller weldments, Lachine now has two large stress-relieving furnaces in one shop.

Baash-Ross Opens Large New Plant in Odessa

The recent opening of its large new plant in Odessa, Tex., adds another important link to the network of Baash-Ross manufacturing plants, maintenance shops, and field warehouses located throughout the nation.

Situated on a 5-acre site on Andrews Highway about 2½ miles north of the central business district, the Odessa plant provides 46,000 sq. ft. of working area under roof and craneway.

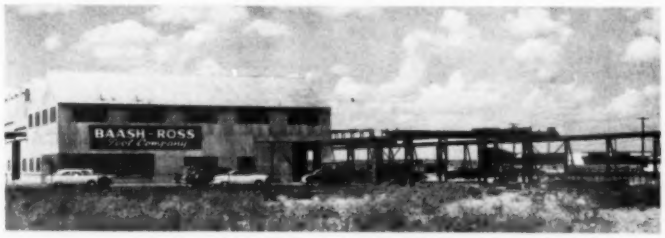
In addition to facilities for handling regular oil-field equipment, special attention has been given to facilities for handling unusually long and heavy items such as drill collars, kellys, and similar equipment. Plant design has been worked out so that these long and heavy items are handled with maximum convenience.

An item of particular interest in the Odessa plant is the newly developed pressure-welding machine which permits welding drill collars together without addition of foreign metal of any kind, thus assuring more uniform physical properties in the finished product.

The cylinder-boring machine installed in the plant makes possible the handling of all types of gas-engine repair work in addition to the wide range of oil-field manufacturing and repair services.

In addition to the manufacturing and machine-shop facilities provided by the new Odessa plant, it will also serve as headquarters for Baash-Ross sales and fishing-tool operations in the West Texas and New Mexico areas.

L. L. (Red) Garren, district manager for West Texas and New Mexico, is in charge of the new Odessa plant, while supervision of the field and plant operations under him are handled by Phil Gibbons, district sales manager; Carl Prichard, district service manager; Gordon Ford, plant superintendent, and Jess Moody, office manager.



The new Baash-Ross plant located at Odessa, Tex.

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BOILERS FOR SALE: Three (3) Code Oil Field Boilers: Two 90 HP "Kewanee," 200# WP; one 110 HP "Oilwell Supply," 200# WP. Operated into 1951 under Maryland Casualty Insurance. Good operating condition. Located Tulsa, Oklahoma. Offered subject to prior sale at $900.00 each F.O.B. Contact Kinslow Power & Equipment, Inc., 817 S. Boulder, Tulsa, Oklahoma.

R. L. Double Drum Cardwell Spudder, complete with tool, Dog House and mast. Telephone 6-9234, Oklahoma City, Oklahoma.

FOR SALE: Miscellaneous used well materials, flow beans, valves, meters, fittings, check valves, etc. All Series 30. Write for list. Michigan Gas Storage Company, Consumers Power Company Building, Jackson, Michigan.

FOR SALE: 1 Buckeye Model 11 trencher with Buda gasoline engine. Contact Natural Gas Service Company of Arizona, Box 127, Coolidge, Arizona, Telephone 4481.

FOR SALE: 18,000' 4" o.d. 6.2 pound, seamless line pipe @ 75c; 6,000' 3½" o.d. seamless line pipe @ 60c. Random lengths 35 to 40'. All of this pipe has good body. It is clean inside and out. Straight, beveled, ready to lay. A coating of anti rust paint has been applied. Recently removed from gas line carrying 100 to 150 pound pressure. Ideal for water, gas, air, or oil line. Your personal inspection will convince you of its merits. Prices f.o.b. our yard, Coffeyville, Kans. M. J. Regan, Phones 448 & 3892.

FOR SALE

10,000' 3¼" x 25' Axelson upset pull rods
1—Reid CK 12¼" x 14" 100 HP Twin Cylinder engine
1—Reid 24' Band Wheel Power
2—6" x 5' 3" Norris Clamp Type Pendulum Multiplier
6—# 912 Norris Pumping Jacks
1—#10 Jensen Pumping Unit with Waukesha x A.H. engine
1—Galvanized Iron Wood Frame Building.

The above equipment dismantled and ready to move located at Freer, Texas.

Contact George Chumley, Phone 4439, Freer, or P. W. Pitzer, Jr., Phone 998, Breckenridge, Texas.

140,000 feet 1" O.D. New Electric Weld Steel Tubing

18 ga. Wall
20 foot lengths
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Subject to Prior Sale

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THalcher 9243

EQUIPMENT FOR SALE

USED ROTARY AND CABLE TOOL DRILLING TOOLS, WIRE LINES, E. A. KELLY, BOX 861, OKLAHOMA CITY. PHONE 5-6407.

FOR SALE: Seamless casing and tubing new and second hand. Phone Rogers Pipe and Supply Co., Tulsa, Okla.

FOR SALE: Approximately 40,000 ft. of 2⅞" o.d. Range 2, 10 and 8 round thread tubing. Suitable for shallow wells, or No. 1 line pipe. Located in Oklahoma City. Call 3-3595 or write Box 2686, Tulsa 1, Okla.

KEYSTONE spudder, trailer mounted, truck and tools. Located Washington County, Oklahoma. Working on seven hundred foot well. Box E-385, The Oil and Gas Journal, Tulsa, Oklahoma.

7 ACRES OF OIL FIELD BARGAINS. Waukesha GAK 165HP Drilling unit, good, $2,500; 3 OCS chain driven sand reels, calf wheel, 6" x 5" Newton falls rig, timbers, good wheels, 14 inch brake wheel; Stems, bits 18" to 5", bailers, sand pumps, everything in cable tools; National No. 2 drilling machine only $1,500. Write, phone or call McGinnis, Tri State Tool & Supply Co., Phone 7-5121, 36th at Jefferson, Box 827, Parkersburg, West Va.

Gaso Duplex 4½" x 6" Power Pumps with Chrysler C-36 Engines, skid mounted, immediate delivery. Also Byron Jackson, Carter Centrifugal Units. Westinghouse 20-25-50 KW Generating Units.

H. H. COFFIELD
Attn.: W. H. ORR
Phones: 122—Rockdale, Texas
AT-3427—Houston, Texas

EQUIPMENT FOR SALE

FOR SALE: One super model Wilson single drum servicing unit, 80 hp. Waukesha, 4,000' wire, all tubing tools, mounted on GM 4-wheel drive truck. $3500. Phone Rogers Pipe and Supply Co., Tulsa, Okla.

FOR SALE—Two (2) Horizontal Steel Tanks, 10½' dia. x 37' long; riveted seams; shell ⅞" thick, dished heads ⅜"; 22000 gallon capacity, 50 psi. working pressure; gasoline storage; good condition, located West Texas. Price $1,100.00. Contact Kinslow Power & Equipment, Inc., 817 So. Boulder, Tulsa, Oklahoma.

6⅝" O.D. CASING

40,000' Used 13# Lapweld, T&C, 20' RL. Suitable casing shallow wells or line pipe. Located Garnett, Kansas.

MID-STATES PIPE & SUPPLY CO.
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8" PIPE IN STOCK

25# and 28# Mixed Good #2 Grade Line. Single Random Lengths, End Beveled.

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100,000' 2¼" O.D. x .140" Wall 3.2# 14' Lengths and Over.
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EXCELLENT FOR HIGH PRESSURE LINE:

5,000' 4" Double Extra Heavy A-106 Grade A Seamless.
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16,000' 2⅜" O.D. 4.6# Once Run J-55 Range 2 T&C, 10 Round Thread Non-Upset Tubing.
20,000' 5½" O.D. 14# Good Used Lapweld Range 1 T&C, 11½ V-Thread Casing.

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ALL SIZES; LINE PIPE AND CASING. TANKS, AND OILFIELD SUPPLIES. EDCO PIPE & SUPPLY CO., PHONES 933 OR 1296, DRUMRIGHT, OKLA.

SPUDDERS, BUCYRUS, Wichita, Fort Worth, also rotaries and core drills. Good used equipment, tools, pipe, cable. Everything for well drilling. Fishing tools rented. Pressey & Son, Pueblo, Colorado.

FOR SALE: Model 61 Wichita Spudder, complete with 150 H.P., LeRoi Drilling Engine, all tools, dog house, light plant, and Shear Pole Mast. Rig is mounted on 12" I Beam Skids. Located in West Texas. Box E-415, The Oil and Gas Journal, Tulsa, Oklahoma.

IMMEDIATE delivery complete workover Jackknife rig, and Lowboy mounted Cardwell, Model L, Power Waukesha GKU with 67' double leg mast and wire line and substructure. Details and price on application. Box 3246, Corpus Christi, Texas.

127' LEE C. MOORE Drilling Mast with 7' substructure and 131' x 18 ft. base. One Lee C. Moore Mast 515 lb. capacity. Immediate delivery. Call Mr. Roland, 2-6318, Oklahoma City.

FOR SALE: New seamless drill pipe, 6700' 3½" OD 13.30# external upset range 1 & 2 Seal Grip and Shrink Grip threads; 2500' 4½" OD 16.60# internal upset range 1 Shrink Grip threads. Box E-380, The Oil and Gas Journal, Tulsa, Oklahoma.

FORT WORTH Jumbo Spudder with or without tools. No Engine. Near Oilton, Oklahoma. Just finished 3000 ft. hole. Priced to sell. Doak Drilling Co. Write or Phone, 1579 Bristow, Oklahoma.

COOLING TOWER PUMP FOR SALE: One Wheeler 6" single stage Centrifugal; 1100 GPM at 60' head pressure; direct connected on cast iron base with dual drive; one (1) 25 HP G.E. electric motor and one (1) 25 HP Curtis Steam Turbine. Kinslow Power & Equip., Inc., 817 So. Boulder, Tulsa, Oklahoma.

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New 4" O.D.
ELECTRIC WELD TUBING

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Used Allis-Chalmers Turbine Driven Air Compressors—

One 23,000 CFM capacity

One 40,000 CFM capacity

Two used Ingersoll-Rand #40, Type APR Pumps with G.E. Group D, Class 1 Motors, vertical drive. All equipment complete and in operating condition.

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3 USED D-13,000 Caterpillars, A-1 shape. 2 12-103 GM Twin diesels. Call or write H. F. (Mike) Ryan, 809 First Natl. Bldg., Tulsa, Oklahoma.

90 H.P. Clark Direct driven Horizontal Gas Engine Compressor. 16"-14" x 20". Includes fuel injector adaptor. Mill Creek Gas & Oil Company, Box 509, Clarion, Pennsylvania.

AS IMPORTERS of Steel we can furnish you with European or Japanese Steel Products of all types. Let us have your inquiries. Hemisphere International Corp., 1404 Hibernia Bank Bldg., New Orleans, La.

EQUIPMENT NOT IN USE: Did you find a buyer in this column for the equipment you have for sale. Someone wants it and an "Equipment For Sale" classified advertisement in the Journal will find a buyer. See box heading for classified rates or write The Oil and Gas Journal.

EQUIPMENT WANTED

WANTED: Suitable unitized portable drilling rig; 3,000 to 3,500 foot capacity; complete with 3,500 feet of 3½" EUE drill pipe, min. 7½ x 12 pump; mast, etc. Send full details and quote price F.O.B. loaded cars. to American Northland Oil Company, 127 Montgomery St., San Francisco, Calif.

EQUIPMENT WANTED: Complete portable skid-mounted gas compressor unit to handle one million cubic feet daily at 50# inlet pressure and 250# discharge pressure. Write giving complete details. Box 237, Chetopa, Kansas.

WANTED: 15/25 KW—Gasoline or Diesel Generating Unit. 220/440 Volts—60 Cycle, 3 Phase. Red Head Oil Producing Co., Brilliant, Ohio.

WANTED IMMEDIATELY: Good used or new 8⅝" 24 lb. and 7" 26 lb. casing. Prefer location in or near Pennsylvania. Box E-416, The Oil and Gas Journal, Tulsa, Oklahoma.

WILL TRADE 2000' of 3½" drill pipe 30' joints for 2⅞" drill pipe 20' joints with 1⅞" water course or larger. Will trade 24-L Bucyrus spudder (rubber tire mounted) for late model 28-L or 36-L and pay cash difference. C. M. Barrington, Coleman, Texas. Phone 4915.

WANTED: Triplex Type Pumps, minimum 500 barrels per day capacity at 1,000 PSI and 0 to 10 PSI suction and up. 1" Regular Black Line Pipe; 1" long collar line pipe and 1¼" upset tubing. Must be in good condition. Lynch Oil Company, P. O. Box 814, Evansville, Indiana.

WANT EQUIPMENT: Did you find the equipment you wish to purchase in this column? If not, use an "Equipment Wanted" classified advertisement to find it. It is available somewhere and Journal classified advertisements will find it. See box heading for classified rates, or write The Oil and Gas Journal.

HELP WANTED

WANT ROTARY DRILLER, reliable and experienced with core drill rigs similar Mayhew 2000—to drill 1500' to 2000' production wells Central Texas. Send experience record. 2018 W. T. Waggoner Bldg., Fort Worth 2, Texas.

WANTED: Petroleum Engineer versed in Gas Measurement and Gas Testing. Location South Central Louisiana. House, utilities, salary $247.50 per month. State age, education and experience. Box E-403, The Oil and Gas Journal, Tulsa, Oklahoma.

HELP WANTED

WANTED
Research and Development Engineer capable of taking charge of department with Oil Field Equipment Manufacturer. Reply giving complete resume stating age, education, experience, positions held, and salary expected. All replies confidential. Box E-346, The Oil and Gas Journal, Tulsa, Oklahoma.

POSITION available to handle gravity interpretation in Geophysical Department of established oil and gas company, operating principally in the Gulf Coast. Geological background and Gulf Coast experience desirable. Permanent location. Salary open. Give all relevant information in first letter. Personal interview to be arranged. Box E-394, The Oil and Gas Journal, Tulsa, Oklahoma.

KEY Seismograph Personnel Needed by Established and Expanding Seismograph Company. Box E-364, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED - ENGINEERS
For WORK in TULSA, OKLA.

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Reply with personal background, education, experience, and salary expected. Personal interviews will be arranged.

All replies will be held confidential.

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Box E-405, The Oil and Gas Journal, Tulsa, Oklahoma

HELP WANTED

WANTED: Petroleum or Mechanical Engineers for oil tool design. Field experience desirable. State age, education, experience and salary expected. Box E-319, The Oil and Gas Journal, Tulsa, Oklahoma.

WAREHOUSEMAN — Oilfield, for small wildcat operation in Arabia. Must be capable assuming full responsibility ordering, stock control, disbursing. One year contract. Top wages. Living furnished. No family accommodations. Reply stating age, education, experience, to Box E-408, The Oil and Gas Journal, Tulsa, Oklahoma.

MECHANICAL engineer with degree, three years model shop experience. P. O. Box 2486, Kansas City, Mo.

ENGINEERS, Executives, Technical Men. Salaried positions—$3600 to $30,000. This confidential service for outstanding men who desire a change of connection. Will develop and conduct preliminary negotiations without risk to present position. Send name and address for details. Tomsett Associates, 334 Frick Bldg., Pittsburgh 19, Pa.

GEOLOGISTS under 3 years experience, salary open. Petroleum, mechanical, civil engineers out school under two years having completed training program, salary $380. Excellent employer. Experienced oilwell supply store managers and salesmen, salary $300 to $500. Employer pays our fee. Oil Industry Employment Service, 405 Tuloma Bldg., Tulsa, Okla. 4-5974.

CHEMIST with technical background and thoroughly familiar with latest method of analysis of light hydrocarbons. Send complete record of education, experience and minimum salary expected. Box E-381, The Oil and Gas Journal, Tulsa, Oklahoma.

DRILLING ENGINEER wanted by growing independent oil company in West Central Texas. Must be graduate petroleum engineer with two or three years of experience in drilling operations. Please reply by letter furnishing complete personal data, experience, age and starting salary desired. Recent small photo or snapshot would be helpful. Interview will be arranged if justified by data furnished. Box E-385, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED: Process Engineer who has had at least five years refinery experience. Box E-367, The Oil and Gas Journal, Tulsa, Okla.

THE POSITION YOU WANT: Oil industry companies are looking for men to fill every conceivable kind of position. If you didn't find the position in this column that you are looking for, use a "Situation Wanted" classified advertisement to state your qualifications. Some company is probably looking for your ability. See box heading for classified rates or write The Oil and Gas Journal.

SALES ENGINEER

Engineer with production experience, or experienced production man with engineering knowledge to sell and service reputable lines gas regulators, liquid meters, gas-lift equipment, with headquarters Lake Charles, or New Iberia, La. Also new opening new headquarters in Beaumont. Must be over 26 years of age, personality and appearance for sales work. Salary and commission. Automobile furnished. Please furnish detailed experience and minimum salary. **Box E-383, The Oil and Gas Journal, Tulsa, Oklahoma.**

SITUATIONS WANTED

FORMER Independent Oil Operator ten years, with legal education, plus eight years Wall Street experience, desires connection raise funds exploratory well drilling from excess profits taxpayers. Box E-396, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM ENGINEER: Desires stateside or foreign employment, three years experience, exempt from military service. Box E-411, The Oil and Gas Journal, Tulsa, Oklahoma.

ATTENTION: Well established oil well drilling contractor desires to manage and supervise: Individuals', groups', small or medium-sized oil companies' drilling, production and operating problems in Central and Western Texas, and New Mexico. Personal interview by appointment is desired. Makin Drilling Company, Box No 131, Ph. No. 131, Hobbs, New Mexico.

SITUATIONS WANTED

GEOLOGIST with years of domestic and foreign surface and subsurface experience desires position with an aggressive exploration or progressive independent company in the Rocky Mountain Area. Box E-384, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM ENGINEER, age 30, married, experienced production, drilling, completion, workover, etc. in West Texas, West Central Texas, and Gulf Coast. Desires connection with aggressive independent. Box E-391, The Oil and Gas Journal, Tulsa, Oklahoma.

EXPERIENCED EXECUTIVE
ADMINISTRATIVE ASSISTANT
GRADUATE PETROLEUM ENGINEER, 39 years of age, 18 years experience covering Planning, Engineering and Administrative assignments in the Drilling, Producing and Pipeline Divisions of the Oil Industry including Purchasing, Inventory, Material Control and Sales Duties. Staff assignment P.A.W. programing materials last war. Presently employed by Industry in Supervisory capacity; desire change, must be permanent, with aggressive and well established Independent Oil or Gas Company. Prefer to locate in Houston. Box E-390, The Oil and Gas Journal, Tulsa, Oklahoma.

INDEPENDENT OPERATOR — Geologist and geophysicist with over twenty years exploration experience with major companies and unusual discovery record desires connection with aggressive independent. Box E-410, The Oil and Gas Journal, Tulsa, Oklahoma.

DISTRICT Representative and Sales Engineer and trouble shooter of Oilfield Equipment. API-ASME Degree. Married, 31, family. Desire immediate change in Midland-Odessa area. 12 yrs. experience. References G. W. Harmon, 1302 W. Washington, Midland, Texas.

MECHANICAL Engineer, Texas A. and M. graduate, desires permanent position with promising future. Three years oil field experience; sales engineer for service company; drafting experience. M. T. Walker, 3945 Earl, Fort Worth 11, Texas.

RECENT graduate, with B. Sci. in geology, seeks employment with major oil company as Jr. Geologist. Prefer Rocky Mountain or Mid-Continent area, but will go elsewhere. Married, 27, veteran. Box E-397, The Oil and Gas Journal, Tulsa, Oklahoma.

MR. INDEPENDENT OPERATOR: Are you looking for that capable superintendent, who can take over all of your operational worries and problems? Twenty-one years' experience: drilling, completions, production (flowing-pumping), workovers, salt water disposal, secondary recovery, compressor gas plant construction, practical petroleum geologist, University of Oklahoma graduate in petroleum engineering, Mid-Continent and Rocky Mountain experience. Responsible jobs with majors. Presently employed as superintendent; available November 1. Reason for change: desires to establish residence in one locality to rear family in normal manner. Box E-400, The Oil and Gas Journal, Tulsa, Oklahoma.

ENGINEER, age 31, 7 years of lab., field, staff-line experience, desire change from major to progressive independent as reservoir-evaluation engineer. Box E-406, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST: Experience in subsurface, well sitting, promotions, leasing, drilling, and Geophysical interpretation. Wants salary and interest arrangement with aggressive oil company or individual investor. Box E-407, The Oil and Gas Journal, Tulsa, Oklahoma.

THE RIGHT MAN: Can you fill the position you have open from the qualifications listed in this column. Men are always looking for an opportunity to improve themselves. Use a "Help Wanted" Journal classified advertisement to find the men you need. See box heading for classified rates or write The Oil and Gas Journal.

GOVERNMENT EXECUTIVE-ENGINEER

Petroleum Production Education, 5 yrs. Str. design large Govt. Bureau, 5 yrs. general contracting, 5 yrs. Corps of Eng. WW II, 5 yrs. legal and contract exp. Age 43. Exc. health. Active, alert, dependable. Desire resp. pos., oil industry, Rocky Mt. area. Box E-414, The Oil and Gas Journal, Tulsa, Okla.

ROYALTIES

MONTANA ROYALTIES
Millions of acres now leased by world's major companies, with huge drilling play in prospect. For booklet describing Montana geology and oil development, write Landowners Royalty Company, Box 1235, Great Falls, Montana.

GET TOGETHER: Both Capital and Royalties are available. If the investment proposition you want isn't listed in this column, use a Journal classified advertisement to find it. See box heading for classified rates, or write The Oil and Gas Journal.

LEASE AND DRILLING BLOCKS

FOR SALE: Oil and Gas Leases in shallow territory. If interested in a good development proposition near oil producing wells write or wire W. P. Harley, Bowling Green, Ky.

INTERESTED in drilling several wells not over 4,000' in North Texas by December 15th. Give complete description and full details, Box 4343, Dallas, Texas.

WILL pay cash instantly for leases (large blocks), royalties, mineral deeds, production. Write fully—P. O. Box 2153, Denver, Colorado.

UNIT No. 1: N½SE¼, SW¼SE¼ of Section 14, Township 3-North Range 1-West, containing 120.00 acres, more or less, the same being within the ceded portion of the Shoshone or Wind River Indian Reservation, Fremont County, Wyoming. Unit No. 2: NE¼ of Section 14, Township 3-North, Range 1-West, containing 160.00 acres, more or less, the same being within the ceded portion of the Shoshone or Wind River Indian Reservation, Fremont County, Wyoming. Brinkerhoff Drilling Co., 804 Continental Bldg., Dallas 1, Texas.

300 ACRES Bartlesville Sand lease 24 old oil wells still producing past fifty years. Sinclair purchases oil. Depth Six Hundred feet average sand 25 to 35 feet. Plenty gas, water, electricity for water flood. Want proposition from reliable company able to go ahead and flood property. Ed Karns, Jr., Box 408, Coffeyville, Kansas. Phone 1883.

OIL LEASE—41½ forties in Beauregard Parish, Louisiana, deep pay area, between three shallow exploratory "drys," presently leased. Lease to reliable company, or, bona fide drilling proposition considered. No mail or telephone inquiries. Alice Dickinson et al., Lake Arthur, La.

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For a QUICK, CLEAN, "THROW" @ 40 to 1! $25,000 expense gets you 1,000,000 bbls. (40 API) of elec. log indicated oil at 1250', 19' sand, 160 acres. Well drilled soon. TAKE ALL OR ANY PART of 50% undivided working interest. Send cashiers check for 10% your share, as good faith deposit, with your inquiry. FIRST COME FIRST SERVED. GOOD LUCK SYNDICATE, Box E-412, The Oil and Gas Journal, Tulsa, Oklahoma.

LEASES ROYALTIES
Producing and Nonproducing
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Inquiries Invited

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6835 Delmar Ave., St. Louis 5, Mo.

WANTED
OIL INTEREST

I am in a position to furnish oil country tubular goods: casing, tubing, etc., for interest in well for depth up to and including 6,000 ft. Wire or call collect your offer to

DAVID A. SCHLACHTER
6105 Del Norte Lane, Emerson 6026
DALLAS, TEXAS

LEASE AND DRILLING BLOCKS

FOR SALE: On a distinct fault, 3000 acres livestock and timber farm in the famous black land, timber and livestock belt of Alabama with half oil rights. Large oil field in adjoining county. Also a large solid block of leases on the same fault, for a well. Write Box A, Linden, Alabama.

LOOKING FOR A LEASE? There will be over 40,000 wells drilled this year. If you are looking for a lease, drilling block, or drilling deal and haven't found it in this column, or if you have a lease or drilling block you want drilled, a Journal classified advertisement can find an interested party. See box heading for classified rates, or write The Oil and Gas Journal.

REAL ESTATE

LOWER Rio Grande Valley — 60 acres, three miles from city, paved road, beautiful home facing lake, bearing citrus orchard, cotton land, three apartments, yearly income about $15,000. Box E-404, The Oil and Gas Journal, Tulsa, Okla.

TRANSFERRED to Chicago? Oil man has 5 room brick residence; 6 years old; suburban atmosphere; in Northwest section of Chicago; close to schools and transportation; master bedroom 12' x 18'; automatic heat; blinds; drapes; Bendix washer; garage; side drive; priced to sell, $17,000. Edison-Norwood Realty Company, 6774 N. Northwest Highway, Chicago 31, Illinois. NEwcastle 1-5544.

SPACE IS NEEDED: A Journal display classified advertisement is the quickest way to rent or sell your real estate. In the present period of expansion oil industry firms urgently need the space you have available. If it isn't listed here, you may also find it by stating your needs in these pages. For classified rates see box heading or write The Oil and Gas Journal.

WANTED

HAVE 4000 Square feet warehouse space office personnel, switch track, truck. Want exclusive distribution national advertised line consignment basis. Can furnish bond. Box E-413, The Oil and Gas Journal, Tulsa, Oklahoma.

FOR SALE—MAPS

NORTH DAKOTA MAPS—Base Map of North Dakota: County outline, Township and Range, location of wells and Operators name with total depths. Oil and Gas Fields. 1" — 8 miles. Price $5.00. COUNTY MAPS: Fee ownership and lease with expiration dates. Scale 1" — 4,000 Ft. Northwest Mapping Co., 117½ Fourth St., Bismarck, North Dakota.

LEGAL BLANKS

BURKHART LEGAL BLANKS since 1908 Oil-Gas (all states), Business, Real Estate, Legal Forms, Leases, Revised With Government Regulations, Commercial Printing. Catalog and Samples on request. Burkhart Printing & Stationery Company, 115 South Cincinnati, Tulsa 3, Oklahoma

BUSINESS OPPORTUNITIES

ATTENTION—MANUFACTURERS
Will sell outright, Patent #2,527,456 covering torque and or tension measuring means for tong arms. Box E-409, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED: $350,000 for building and operating 2,000 B.P.D. topping and cracking refinery well located. Plenty crude and extra good market. Box E-387, The Oil and Gas Journal, Tulsa, Oklahoma.

WANT
N. Y. EXPORT REPRESENTATION?

Long established and well known oil well equipment manufacturer who has maintained N. Y. export office and sales personnel for many years, is now in a position to handle additional representation in New York for high quality manufacturers of oil equipment items. If you're looking for increased export business, write for further information. All replies held in strict confidence.

Box E-359, The Oil and Gas Journal, Tulsa, Oklahoma

FINANCING

YOUR FINANCING PROBLEM can be solved at moderate cost. For details write Box E-241, The Oil and Gas Journal, Tulsa, Oklahoma.

LEASE SERVICE

RECORD TAKE-OFF, available. Listing all Oil leases and assignments as recorded in Grant County, at Carson, North Dakota. Giving complete information. Also monthly continuations made. Write P. O. Box 344, Carson, North Dakota.

INTERNATIONAL

LATIN AMERICA

(Continued from page 85)

Another Jose Colomo Well

The third well without a dry hole has been completed by Petroleos Mexicanos in Mexico's new Jose Colomo field, in southern Tabasco.

Pemex officials said Jose Colomo 3 recently was producing 500 bbl. per day on a 5/16-in. choke and is considered as good a well as the discovery, which they say is producing 1,900 bbl. per day.

Pemex now has three rigs operating in the field and plans to add three more late this month and two more early in December, bringing the total to eight. Present schedules call for completion of 10 wells before the end of this year. Results of drilling to date have made Mexican oil officials enthusiastic about the field's ultimate possibilities. One asserted it soon will prove to be "a second Poza Rica," but with a higher-gravity crude and without the high sulfur content of Poza Rica.

The field, named after Pemex's executive subdirector in charge of production, was discovered by the government agency's 1 Jose Colomo, which was brought in April 19. Pemex says production is from 5,200 ft. in a sand formation with a 600-ft. pay zone.

It was reported reliably that Jose Colomo 2, which came in wild but was brought under control, will be produced as a gas well. No. 4 well is located on the flank of No. 2, where Pemex expects to find less gas.

Tabasco Oil Test Planned

Petrofina, the Belgian partner in Mexican American Independent Oil Co. (CIMA), plans to spud in soon on a wildcat on the Macutapec structure in Mexico's State of Tabasco.

The project will be undertaken independently of CIMA, but it is understood that E. W. Pauley, also a partner in CIMA, will participate in the operation. Petrofina (Cia. Financiere Belge des Petroles) owns 43⅓ per cent, and Pauley 13⅓ per cent of CIMA. Actual operations will be under Mexofina, the Mexican affiliate of Petrofina.

Equipment is expected to be moved onto location late in October or early in November. It is understood that the company will seek production in a Cretaceous limestone formation. If successful, it would be the first limestone production in the Isthmus of Tehuantepec region.

Petrofina's interest in developing crude-oil production in the Western Hemisphere stems largely from the loss in the last war of its Romanian production and a desire to reestablish its prewar integrated scope of operations. (For details of Petrofina's world-wide operations, see *The Oil and Gas Journal, May 31, 1951, page 70.*)

International Briefs

Guatemala has been advised by the International Bank for Reconstruction and Development to cut its 22-cent gasoline tax in half. The country would be faced by an immediate loss in revenue, the bank said, but the loss would be more than made up eventually through the encouragement of wider use of motor vehicles. The high tax brings the retail gasoline price to 50 cents a gallon. At present the critical financial condition of the country suggests that the tax-cutting recommendation will not be followed in the immediate future.

Concessions which will permit construction of two small refineries have been granted by the Italian Ministry of Commerce and Industry. CICSA, an Italian company with headquarters in Trieste, has been granted a permit to build a 4,000-bbl. refinery at Porto Nogaro. A second permit has been granted to Societa Arionaria Raffinazione, a newly formed company which plans to construct a 1,700-bbl. plant. Location of this plant was not announced. Applications of several companies to expand existing refineries are now pending before the ministry.

The British Adventure, the first of 12 large tankers ordered by British Tanker Co., subsidiary of Anglo-Iranian Oil Co., Ltd., was undergoing trials last week in the Firth of Clyde. The 28,000-ton ship is 643 ft. in length and brings the company's seagoing fleet to 151. The company now has on order five more 28,000-ton ships, which are now under construction, and six 32,000-ton tankers.

A 6,500-ft. test has been spudded in by Deutsch Erdol, A.G., on the tiny island of Helmsand, in the North Sea. The wildcat is the second oil-exploratory well of any depth to be drilled off the German mainland. Helmsand is about 2 miles off shore. The company hopes to find the Rhaetic reservoir beds west of the Heide salt dome structure. The formation had shown traces of oil in a well previously drilled on the mainland.

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Subsidiaries Run High

WASHINGTON. — Thirty-five corporations in the oil industry have interests in more than 1,200 subsidiary and affiliated companies, the Federal Trade Commission has found in counting the holdings of 1,000 large manufacturing corporations which make such information known.

The commission survey showed that with 3.5 per cent of the companies covered the oil industry had almost exactly one-sixth of the 7,557 subsidiaries and affiliates of the 1,000 corporations. The 1,266 interests reported by the 35 companies did not represent that many separate entities since in a number of instances, particularly in operations abroad, two or more companies have interests in the same concern.

The commission's study made as of 1948, lacked information regarding a number of large corporations which do not publish financial reports, but since the great majority of the larger corporations do publish reports, it said, the listing can be regarded as fairly representative of the large business community.

To the oil industry falls the distinction of having the company with more subsidiaries and affiliates than any other in the country—Standard Oil Co. (N.J.), with 322. Only 189 of the 1,000 corporations have no interests in other companies.

Design Capacity Boosted

Standard - Vacuum Oil Co. has boosted the design capacity of its soon-to-be-built Durban, South Africa, refinery to 15,600 bbl. per day.

The project, which originally called for an expenditure of $12,500,000, now is expected to involve an investment of more than $17,000,000, a company announcement said.

Foster Wheeler Corp. has construction contract and currently has a team of engineers in South Africa making preliminary preparations for the initial construction work.

The plant will feature a combination-type unit combining fluid catalytic cracking with crude distillation and thermal reforming functions. Products will include motor gasoline, kerosines, automotive and industrial diesel fuels, and light and heavy grades of fuel oil.

LEGAL

100.75 ACRES of individually allotted, restricted Indian land, located in Sections 27 and 34, Township 13 South, Range 24 East, Salt Lake Meridian, within the jurisdiction of the Uintah and Ouray Reservation, Utah, are being advertised for lease, bids on which will be opened October 29, 1951, at 2:00 P.M., at the office of Forrest R. Stone, Superintendent, Uintah and Ouray Agency, Fort Duchesne, Utah. Full particulars may be obtained from Mr. J. R. Schwabrow, U. S. Geological Survey, Casper, Wyoming, or from the Uintah and Ouray Agency.

LEGAL

U.S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Washington 25, D.C. Notice is hereby given that two parcels of land containing approximately 27.5 acres in the Red River oil field, Tillman County, Oklahoma, will be offered for oil and gas leasing through competitive bidding at 1 p.m., Eastern Standard Time, on December 5, 1951, when bids will be opened. Details of the lease offering, how and where to file bids and a description of the lands may be obtained by addressing an inquiry to this office. Marion Clawson, Director.

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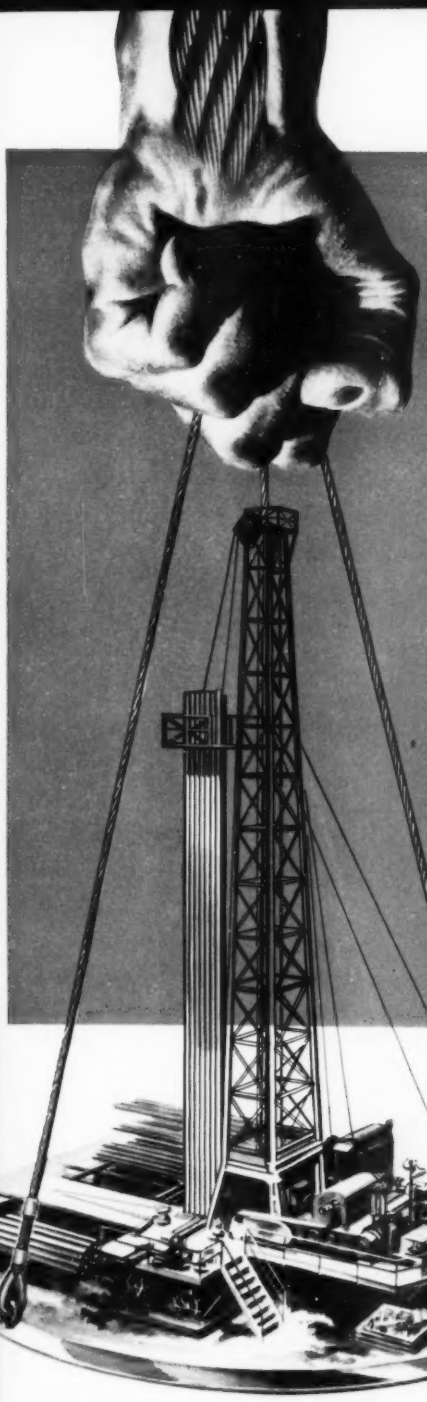

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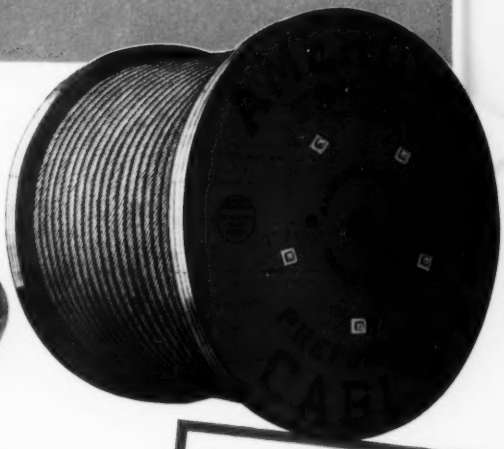

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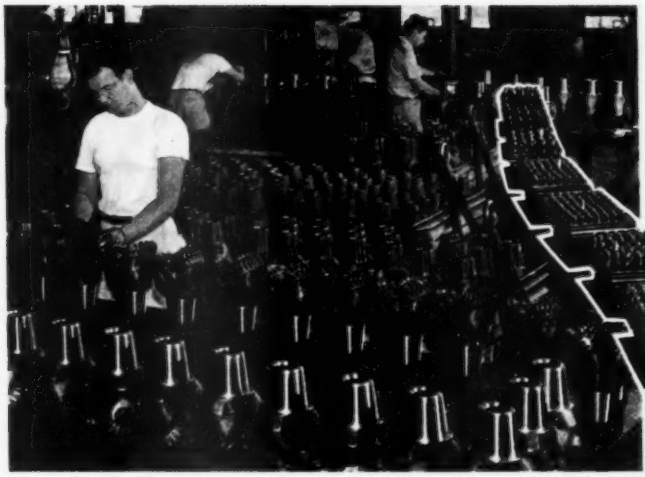

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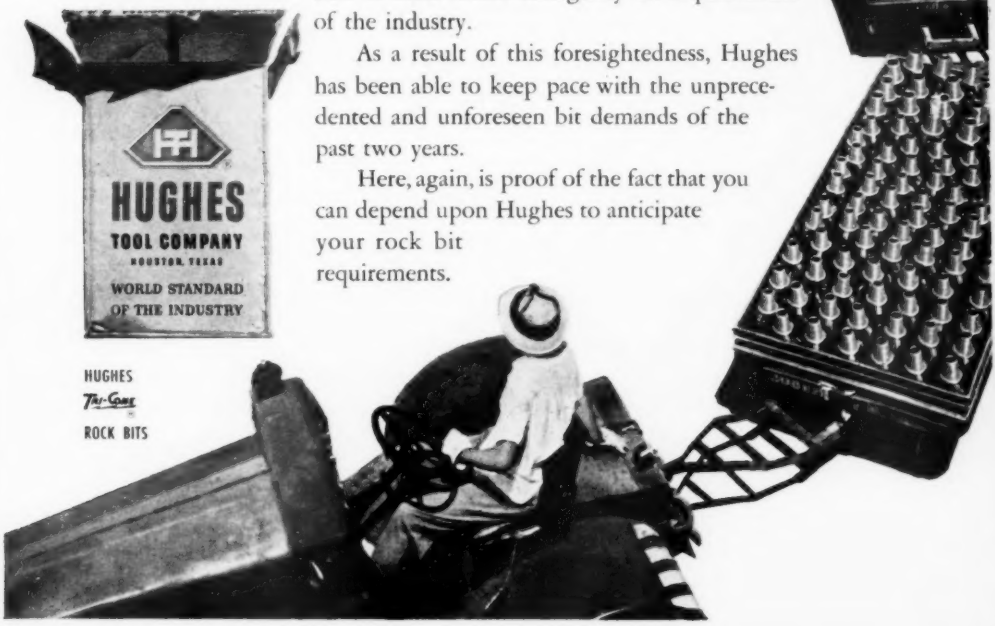
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